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THE IRON TRADE REVIEW

VOLUME XXXII. CLEVELAND, O. DECEMBER 7, 1899. CHICAGO, ILL. NUMBER 49

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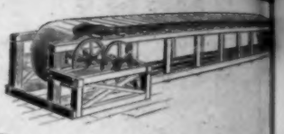

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THE IRON TRADE REVIEW

VOLUME XXXII. CLEVELAND, O. DECEMBER 7, 1899. CHICAGO, ILL. NUMBER 49

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

The iron trade has come upon a period of quiet which recalls, by contrast, the fact that the beginning of the present wave of prosperity came in the closing month of last year. The feeling that a quieter market is necessarily a weaker market survives from the recent period in which production was always in excess of consumption, and some current market estimates are tinged by this sentiment, though as yet the facts of the situation do not warrant anything but predictions of continued strength. It is noted by large interests whose product goes into many important channels of consumption, that while there is a lull in buying, specifications are on a scale indicating a maximum rate of consumption in all lines unaffected by the closed season. Here and there mills are going after business with something of an aggressiveness that has not been seen in recent months, but nothing appears as yet to indicate that these exceptions are more than incidents of the winter season. Short time deliveries are the rule in new transactions, indicating that sellers and buyers are disposed to tide over an interval. As the significance of the new basis for iron ore is more fully appreciated throughout the trade, it is taken as an argument for the maintenance of high level prices through 1900. Sales of ore begin on Monday, Dec. 11, and already requisitions are in hand for very large percentages of the favorite ores. It has developed that while old-range Bessemer mines, by estimates recently made, cannot produce as much in 1900 as in the present year, the old-range non-Bessemer properties, in spite of the increase in their number this year, will just equal, and no more, the output sold on the general market this year. Whatever net increase there is in old-range non-Bessemers goes to miner-consumers. The Mesabi range, therefore, is looked to for the bulk of next year's increase. The week has brought little activity in pig iron. A far Western steel works has been in the market for a block of Central Western Bessemer iron, but valley furnaces figure that their sales are now within 10,000 to 20,000 of estimated production, running without interruption to July 1. A pipe works contract in Central New York requiring 3,000 or 4,000 tons was probably the largest sale of the week. Eastern pipe works have not taken hold largely for next year. There is no new development concerning steel billets and sheet bars, and it is predicted that mills will pay substantially to-day's prices for the first half of the year. Buyers are holding off for lower figures. The weak prices in plates and sheets recently noted continue; but in bars the market is stronger. The leading bar iron producer is reported sold for more than three-fourths of its product to July 1.

PITTSBURG.

OFFICE OF *The Iron Trade Review*,
705 PUBLICATION BUILDING, Dec. 6.

The course of the iron and steel market in the week under review has shown that even the wonderful activity of the past few months must yield to the rule which has always, except last year, made December a comparatively dull month. All through the line of finished material trade has been decidedly slack. Mills are running by no means as full as they were, and stocks of both raw and finished material have accumulated. It is only in exceptional cases that a premium must be paid to secure prompt delivery. But the feeling among the large producers, who have excellent opportunities to forecast, is that the opening of the new year will see a large volume of business and higher prices. As the premiums which were paid recently for quick delivery have gradually disappeared, buyers have interpreted the movement as an indication of weakness and have started holding off. In view of the very strong position of raw materials, the bottom certainly has been nearly if not quite reached, and it is predicted that the moment prices take an upward turn buyers will rush into the market and put prices up on themselves. It is so well known that a considerable part of the advance just experienced was due to an unnecessary urgency to place orders, that it might be supposed buyers would next time act with more regard for their own welfare; but this is by no means certain.

Those with the best judgment in the trade are making no effort to sell, regarding it better to allow a breathing spell and allow the natural course of demand to regulate prices and business. Those who are making an effort to sell are finding that concessions only scare off buyers altogether, and there is not very much of this being done.

The great number of new industrial enterprises which are announced each week give assurance that there will be a good demand next year all along the line. The new plants projected will require iron and steel in their building, and they will work up material, thus furnishing an outlet after their completion. The machinery builders are so busy that they cannot make quick deliveries in anything, and thus new construction is delayed and spread out in a healthy way.

Galvanized sheets constitute about the weakest line in the list, but the weakness is due in part to the low price of spelter, which is selling for a lower price than for several years. The weakness in black sheets has something to do also with the case, but sheets have not weakened a great deal since last report. The plate market is no firmer than it was, while there have been some offers of plates at remarkable prices, but they have not served to fix the market, which is nominally unchanged. In steel billets the market is very quiet, but producers are not forcing the market, rather waiting until matters are fully adjusted.

PIG IRON.—There have been sales of odd lots of Bessemer pig iron for delivery between now and March 1, prices ranging from $24.25 to $24.75, valley, the lower price being for lots of a few thousand tons each, while the higher price has been paid for orders of a few carloads. There are negotiations pending for a block of second and third quarter iron, which will probably be closed by the end of the week. It is understood that $24 is a minimum price for second or third quarter iron, while some furnacemen feel that a higher price should be had for second quarter iron. In gray forge and

foundry iron the market is decidedly quiet, and prices are scarcely as strong as they were. We quote the market as follows for next year's delivery:

Bessemer, valley furnace	$24.00	to	$24 25
Bessemer, Pittsburg	24.90	to	25 15
No. 1 Foundry	23.75	to	24.00
No. 2 Foundry	23.00	to	23.25
No. 3 Foundry	22.25	to	22 50
Gray Forge, valley furnace	20 50	to	21.00
Gray Forge, Pittsburg	21 00	to	21 50

STEEL.—The market for steel billets is very quiet. Producers feel that present prices are fully warranted by the state of affairs in raw materials, and are not making any effort to force business. Some little steel in second hands has been sacrificed, and this has not helped the market any. We quote Bessemer billets at $35 to $37 for ordinary lots for prompt or next year's delivery, and basic open-hearth billets at $45 for the same deliveries.

FERRO-MANGANESE.—There is nothing new in this line, and $100 is still quoted for large lots.

RAILS AND TRACK MATERIAL.—There are orders placed now and then for rails at the standard quotations, but the situation is rather quiet. In track material the usual demand keeps up. With the approach of the winter months the railroads are stocking up on links and pins to make up for losses on account of the snow. We quote prices unchanged on rails and track material as follows: Rails, standard sections, over 200 tons, $35; 100 to 200 tons, $37; car lots, $38; less than car lots, $40; light rails, 25-pound, and less than 50-pound, $37, all f. o. b. mill, Pittsburg; track material—Spikes, 2.50c; track bolts, square heads, 3.60c; hexagon heads, 3.85c; splice bars 2.50c to 2.60c; links and pins, 3c to 10c.

BARS.—While the market for bars is quiet, prices are pretty firmly held. On ordinary orders nothing below 2.25c can be done for steel bars, while iron bars from all-muck stock are held at a trifle higher figures.

STRUCTURAL MATERIAL.—The outlook is very good for a large volume of business next year, as a great deal of building is projected. The new industrial plants which are being built steadily for various purposes are consuming a large quantity of structural material. We quote prices unchanged as follows: Beams and channels, 3 to 15 inches, 2.25c; 18 to 24 inches, 2.35c; tees 2.30c; zees, 2.25c; angles, 2.25c. Universal mill plates, 2.50c to 2.75c, according to delivery and size of order.

PIPES AND TUBES.—The demand for pipes and tubes keeps up very well for December. There is a good inquiry for export, and a considerable tonnage of material is being exported at full prices. The outlook is very good for an increase in our exports in this line, as the British and Continental makers have just advanced their prices. It is noteworthy that the American mills can readily secure orders on anything that is out of the regular line, as they are ready to meet conditions and supply material in the form in which it is wanted, while for any irregularity the foreign makers at once mark up their figures. We quote prices unchanged as follows: Merchant pipe, 50 and two 10's for car-loads delivered within the specified territory; well casing, screw and socket joint, 37½; inserted joint, 32½, with an optional 5 per cent to dealers only; boiler tubes 1¼-inch to 1½-inch, 40 per cent off; 1¾-inch to 2½-inch, 50 per cent off for iron, and 55 per cent off for steel; 2¾-inch and larger, 52½ per cent off for iron and 55 per cent off for steel, with 5 per cent additional in carloads, less than carloads being f. o. b. mill.

PLATES.—The plate market, while no stronger than last week, is not notably weaker, and we quote regular market figures unchanged. At the same time it should be noted that some mills, especially on narrow plates, are a little anxious for business, and some prices have been quoted which tend to unsettle the market. Other mills are very firm in their quotations, and have entire confidence that within a month or two prices will be considerably higher. The wide range between prices on narrow and wide plates continues. We quote prices as follows, for either prompt or next year's delivery: Tank plate, under say 50 inches in width, 2.40c; over 50 inches, 2.50c; very wide plates, 2.60c; shell steel, 2.60c to 2.70c; flange 2.70c to 2.80c; and fire box 3¼c to 4c.

SHEETS.—The sheet market is about the weakest in the list, especially for galvanized. The demand is very poor, and mills find it impossible to force sales by quoting lower prices. Most of the mills, however, are adhering to about their former quotations and are willing to let matters take their course. The general market quotations are on the basis of 2.95c to 3c for No. 28 gauge. On a nice order for this gauge a little lower figure could be done, but the relation might not hold good for other gauges. Galvanized sheets are much lower, and 75 and 10 per cent off, with a 15-cent freight allowance, can be done on carload orders. Compared with prices secured in the late summer, up to 70 and 5 off, this is a decline of a round 20 per cent. A large part of the weakness in galvanized sheets is due to the demoralized condition of the spelter market.

SPELTER.—This metal is lower than it has been for a long time, and fully a third below what it sold for only a comparatively short time ago. We quote prime western grades at 4 30c to 4.40c.

OLD MATERIAL.—Most lines are rather scarce and prices continue decidedly high. We quote old steel rails, cast material and wrought scrap from $1 to $2 a ton higher, while other prices, though irregular, are about as last given: Pittsburg gross tons, except where otherwise specified: New Bessemer melting stock, $26 to $27; basic open-hearth scrap, $28 to $30; steel rails, mixed lengths, $22 to $23; short lengths, $23 to $24; iron rails, $29 to $31; cast borings, $14 to $15, net tons; cast scrap, $18 to $20; No. 1 wrought scrap, $24 to $25, net tons; busheling scrap, $16 to $18, net tons.

COKE.—The shipments of Connellsville coke for the month of November footed up 35 251 cars, which is only a few cars less than the number for October, which month was the largest in the history of the Connellsville coke region. The market is rather quiet, and we quote prices for next year unchanged at $2.75 to $3 for strictly Connellsville furnace coke, and $3 for foundry coke. For quick shipment as high as $3.50 has been paid for foundry coke.

CHICAGO.

Office of The Iron Trade Review,
1522 MONADNOCK BLOCK, Dec. 6.

Market conditions are very much as they were a week ago. The demand is not large, and sales were rather smaller than have been the rule of late. Not much business is expected to be closed between now and the first of the year.

PIG IRON.—The week's business has been composed almost entirely of small orders, the largest contract placed being for only 500 tons. The demand is light. Sellers are looking for a heavy buying movement shortly after the first of the year, however, and predictions are made that if it is anything like as large as is expected it will send prices up another notch or two. In the meanwhile the market is steady. Northern furnaces are asking $24.50 for No. 2 foundry iron, which is $1 higher than our previous quotation, but is not actually higher than the iron has been selling for for some time past. As a matter of fact, prices on most grades of iron are merely nominal, especially for immediate delivery, as there is very little iron in the market, and buyers who need it for prompt shipment pay and are willing to pay considerably more than quoted prices. Southern prices have been marked up 15 cents a ton, to correspond with the advance of 15 cents in freight rates, which takes effect Jan. 1. Iroquois furnace, which has been out of blast for several weeks, for repairs, started up again last Saturday. This will relieve the situation to some extent. Quotations are as follows:

Lake Sup. Charcoal	$25 50	@	$26 50
Local Coke Fdy. No. 1	25 00	@	25 50
Local Coke Fdy. No. 2	24 50	@	25 00
Local Coke Fdy. No. 3	24 00	@	24 50
Local Scotch Fdy. No. 1	25 00	@	25 50
Local Scotch Fdy. No. 2	24 50	@	25 00
Local Scotch Fdy. No. 3	24 00	@	24 50
Southern Coke No. 1	23 00	@	24 00
Southern Coke No. 2	22 00	@	23 00
Southern Coke No. 3	$21 00	@	$22 00
Southern No. 1 Soft	23 00	@	24 00
Southern No. 2 Soft	22 00	@	23 00
Southern Silveries	26 50	@	27 00
Jackson Co. Silveries	32 00	@	32 50
Ohio Strong Softeners	24 50	@	25 00
Alabama Car Wheel	24 00	@	26 00
Malleable Bessemer	24 00	@	25 00
Coke Bessemer	25 00	@	26 00

BARS.—The demand is not large, and business last week was of comparatively small dimensions. The market is firm at 2.35c to 2.50c for both common iron and steel bars, half extras, Chicago delivery.

STRUCTURAL MATERIAL.—No large sales were made last week, but the demand for small lots is good, considering the season, and considerable orders of this class were closed in the week. Quotations are as follows: Beams, 15 inches and under, 2.40c; 18 inches and over, 2.50c; angles under three

inches and over six inches, 2.50c; three inches to six inches 2.40c; sheared plates, 2.90c to 3.15c; universal plates, 2.80c to 3c.; tees 2.45c; zees, 2.40c; small lots from store are quoted from ¼c to ½c higher.

PLATES.—Business is of the small-order variety. The plate market is in a peculiar condition, in that some mills are quoting on light and narrow plates lower prices than can be secured on heavy gauges in varying widths. This is caused by the fact that several mills recently purchased by the tube combination to be used for making skelp have not yet been put to that use, the tube people having sufficient skelp bought to satisfy their requirements for this year. These mills, it is understood, are responsible for the low quotations on light plates, and it is more than likely that they will not be sellers after the first of next month. Plates of light gauges have sold recently as low as 2.65c, Chicago, while heavier plates are selling at 2.85c. The market is not strong and prices are about as follows: Tank steel from store, 3.10c to 3.25c. Mill shipments, Chicago delivery: Tank steel, 2.90c; shell, 3.10c; flange, 3 25c; marine 3.30c; fire box, 4c to 6c, according to brand.

MERCHANT STEEL.—Considering the season a very satisfactory business has been closed. The demand appears to be increasing slightly, and sales were larger last week than in the week previous. Smooth finish tire steel is quoted 2.80c to 3c; smooth finish machinery steel, 2.95c to 3.05c; spring steel, 3.65c to 3.75c; tool steel, 7c to 7.50c; special, 13.50c and upwards.

MERCHANT PIPE.—Sales last week were fairly good and included two or three quite large orders; yet most of the business was in small lots. Prices are unchanged at 50 and two 10's off for mill shipment on large orders, and 50 and 10 and 5 off on small orders.

SHEETS.—There is no change in the situation, and the market is still weak, although prices are no lower than a week ago. The demand for both black and galvanized is light. No. 27 black sheets are quoted at 2.95c to 3.05c, and galvanized at 75 to 75 and 5 per cent off.

BILLETS AND RODS.—The event of the week is the starting up of the new steel plant at Ensley City, Ala., which was accomplished Thanksgiving Day. This plant has some open-hearth basic steel sold, some of which is to be delivered here, and we understand it is prepared to make further sales. It makes a quotation of $36, Birmingham, or $40.75, Chicago, on basic open-hearth billets. Bessemer billets are worth about $37, Chicago, but there have been no sales in the week. Wire rods are worth near $55 for Bessemer, and $65 for open-hearth.

RAILS AND TRACK SUPPLIES.—There is very little domestic demand for rails, either light or standard sections, and sales last week were only small. Quotations are as follows: Rails, standard sections $35 to $38; light sections, $37 to $42; splice bars, 2.50c to 2 70c; spikes, 2.75c to 2.85c; track bolts, 3 65c to 3.85c.

WIRE AND WIRE NAILS.—Sales last week were rather smaller than has been the case of late, due to the season. It is not expected that any large business will be closed until after the first of the year. Considering the season, the demand is exceptionally good. Makers quote single carloads of wire nails at $3.25, f. o. b. Chicago, and $3.35 for less than carloads. On wire current quotations are as follows: Plain annealed wire, $3.10; painted barb wire, $3.70; galvanized barb wire, $3.85.

OLD MATERIAL.—The demand is good, and quite large sales of many classes of material were made in the week. The local market is short of many grades, and buyers sometimes have difficulty in satisfying their needs. The sales of the week include 200 tons of long length steel rails; 500 tons of cast scrap; 500 tons of No. 1 railway forge, and an order for 5,000 tons of steel rails cut to length, besides considerable other business. The demand for steel scrap of all kinds is exceptionally good. Dealers' selling prices are as follows:

Old iron rails, gross,	$31 00@$32 00	Country malleable	$15 00@$16 00
Old steel rails, long, gr.	24 50@ 25 50	Iron axles, net	31 00@32 00
Old steel rails, mixed	20 50@ 21 50	Cast borings, net	10 00@11 00
Relaying rails, gross	30 00@ 31 00	Wrought turnings, net	14 00@14 50
Old wheels, gross	23 50	Iron axle turnings, net	16 00@16 50
Railroad forge, net	25 00@ 26 00	Steel axle turnings	15 00
Dealer's forge, net	19 00@ 21 00	Mixed country steel, gr	15 00
No. 1 cut mill, net	16 00@ 17 00	Stove plates, net	11 50@12 00
Heavy cast, net	16 00@ 17 00	Heavy melting steel, gr	20 00@21 00
Railway malleable, net	17 00	Old iron splice b., net	37 00

CLEVELAND.

OFFICE OF *The Iron Trade Review*,
27 VINCENT ST., Dec. 6.

The announcement of the prices for Bessemer and non-Bessemer ores for delivery next year has caused no great surprise in the consuming trade, though naturally consumers who must buy all their ores in the market could have wished for a lower price. It is estimated that from 12,000,000 to 13,000,000 tons of next year's Lake Superior ore production will go direct to the furnaces of companies operating their own mines or holding interests in mining companies, so that the advance in price directly affects a smaller proportion of the consuming trade than ever. Within the week the various ore selling companies have been figuring and scheduling the values of their ores, on the basis of average analyses for this year, or of guaranteed analysis for next year, and it is arranged that active selling will begin on Monday, Dec. 11. Already by letter, telegram and personal interview the consuming trade has placed its requisitions for large quantities of well known ores, and it is understood that what remains in the case of many old range ores is to apportion the available production among those who have been customers heretofore. As noted last week, the estimates of production for next year, of old-range Bessemer ores sold on the market, have been made by the mine managers, each naturally putting his best foot forward, and these show a total less than the output of the same mines for 1899. The Carnegie and National Steel interests are understood to have no ore for sale; both will use more ore the coming year than in 1899.

The price of non-Bessemer ores for next year and the advance in the price of Bessemers were very generally misstated in other publications of last week. As given in this column, the non-Bessemer base is $4.15, and the Bessemer base of $5.50 is an advance from $2.95 this year. The production of non-Bessemer ores from old ranges is estimated at 4,000,000 tons for next year. Taking out 1,700,000 tons, to be mined by the largest Pittsburg interest, leaves 2,300,000 tons, or just the amount of non-Bessemer ores sold this year. With consumption of these ores considerably increased in the past six months, the indications are that the entire output will be speedily taken up. The base price, $4.15, like that on Bessemer ores is a compromise. As high as $4.50 was favored, but the relation of Southern producers of foundry and forge irons to the question, and the revival of operations in Eastern mining districts, made the problem a different one from that handled by the Bessemer association.

Indications are that the total of water shipments for the year will even exceed 17,500,000 tons. November shipments were not far from 2,000,000 tons, and to Nov. 1 the official total was 15,560,075 tons. Consumers of ore are urging shippers to get down every ton available, representing that on certain ores they are not sure that their supply will be sufficient.

PIG IRON.—A generally quiet market is noted for the week. Bessemer furnacemen have had an inquiry for 10,000 tons of iron for shipment to Colorado. A canvass of orders booked and an estimate of production in the first half of the year shows the associated furnaces sold up within less than 20,000 tons of their make to July 1, 1900, counting on uninterrupted operation. Furnacemen must take account of a higher coke freight after Jan. 1, an advance from $1.20 to $1.35 from Connellsville to the valleys and from 55 cents to 70 cents from Connellsville to Pittsburg, going into effect with the beginning of the year. An advance in the ore rate is also expected. There has been little selling of foundry or forge iron in the past week, and quotations are unchanged:

Bessemer	$24 00	Valley Scotch No. 1	$23 00@23 50
No. 1 Strong Foundry	23 00@ 23 50	Valley Scotch No. 2	22 50@23 50
No. 2 Strong Foundry	22 50@ 23 00	Gray Forge, valley	21 00
No. 3 Foundry	21 50@ 22 00	Lake Superior Charcoal	25 00@26 00

FINISHED MATERIAL.—Specifications on contracts come in in fair volume for the last month of the year, but new business is quiet. The fact that the billet market remains firm at $36 to $37, Pittsburg, in spite of the little doing in steel, has reinforced sellers of finished material in their belief that occasional soft spots are not significant of general conditions. On blooms, both Bessemer and open-hearth, prices of some sellers are up $5, as developed in connection with bids on forging material this week. The bar iron market is quiet, but firm. Out of stock the Cleveland price is still 2.50c, with full extras on less than carload lots. The valley mill price is 1.25c to

1.30c on assorted sizes in carload lots. The plate market is unsettled by the bids on groove-rolled material, and it is on the light gauges and narrow widths that the lowest quotations have developed. We quote tank plate 2.50c to 2.60c Pittsburg, and boiler steel 2.60c to 2.70c Pittsburg on assorted gauges and widths. Lower quotations have been made on light Bessemer tank. Sheets continue inactive and low. We quote 3c Pittsburg for No. 28, but lower prices are reported. On galvanized 75 per cent off is usual.

OLD MATERIAL.—An occasional exception is noted, but the general tone is strong and material is moving well. In foundry, steel works and rolling mill lines the outlook is for a continuance of the demand on a large scale. We quote old iron rails at $29 to $30, valley; old steel rails, $22 to $23, Cleveland; old car wheels, $22; No. 1 railroad wrought scrap, $24 to $25; machinery cast scrap, $17; iron axles, $28; wrought turnings, $13; cast borings, $11.

CINCINNATI.

Nov. 27.

Matthew Addy & Co, say of the pig iron situation: "November was not a month of any very large transactions in foundry pig iron. It was a month of continuous small sales, and December has started out in precisely the same fashion. These small sales range, as a rule, from carload lots up to 500 tons, distributed among all classes of buyers—from the little foundries to the very largest of the industrial combinations. 'Many a mickle makes a muckle,' and the total of the November tonnage was by no means insignificant. The most important event of the week was the starting on Thanksgiving Day of three of the Tennessee Coal Iron & Railroad Co.'s battery of 10 open-hearth furnaces at Ensley, Ala. The start was in every way satisfactory, the first ingots analyzing: Carbon, .15; manganese, .51; sulphur, .013; phosphorus, .02."

So much has been said recently regarding the situation from the consumer's standpoint that possibly the views of the iron master will be interesting. Mr. N. Baxter, president of the Tennessee Coal, Iron & Railroad Co., recently wrote as follows:

"'On the 1st of June, 1898, stocks on furnace yards were 514,361 tons of coke iron, and in the warrant yards about the same date they were 258,000 tons, making together 772,361 tons. By the end of the year, Dec. 31, they were reduced to 313,706 tons of coke iron on furnace yards and on the warrant yards to 150,800 tons, making 454,506 tons. On the 31st of October coke iron on furnace yards had been reduced to 52,133 tons, and the last report (which is Nov. 20th), shows that the stocks in the warrant yards are reduced to 11,300 tons, making 63,433. From June of last year to the end of the year the stocks of coke iron consumed in excess of furnace make was 317 855 tons, and between January and November of this year the amount of coke iron consumed in excess of furnace make is 391,073 tons.

"'The stocks of coke iron consumed in excess of the furnace make is itself largely in excess of the increased production, though I have not at hand the statistics to make the comparison. With no iron on the furnace yards and with practically none in the warrant yards (and I say none on the furnace yards because the small amount barely represents the amount necessary to be carried to meet current orders, including the broken carload lots of different grades

Rogers, Brown & Co. write as follows: "The business of the week has not varied from the general experience of the near past. Notwithstanding production is up to the maximum of the furnaces available, consumption still keeps in advance. The general trade of the country, as reflected by orders for pig iron and the general sentiment expressed as to the future, would seem to indicate the belief that the prevailing prices will not be susceptible of reduction for many months to come. There are those who believe that prices current will be maintained throughout next year. There have been some important transactions this week for round lots at highest figures prevailing for delivery the latter half of 1900. There are no indications of lessening the demand, notwithstanding the approach of weather unfavorable for outdoor work. The railroads continue to be large buyers of cars and all sorts of equipment. Many enterprises that have been held in abeyance, because of the advance in raw material, are being now furthered with the conviction that values will not shrink appreciably, if at all. The demand during the week has been for every class of iron, and inquiries continue numerous and for liberal tonnage." We quote for cash f. o. b. Cincinnati: Southern coke No. 1 foundry, $21.75 to $22.25; Southern coke No. 2 foundry, $20.75 to $21.25; No. 3 foundry, $19.75 to $20.25; No. 4 and gray forge, $19.25 to $19.75; No. 1 soft, $21.75 to $22.25; No. 2 soft, $20.75 to $21.25; Lake Superior coke, No. 1, $24 to $24.50; No. 2, $23.50 to $24; Hanging Rock charcoal, No. 1, $25 to $26; Jackson county silvery, No. 1, $30 to $31; standard Georgia car wheel, $24.75 to $25.75; Lake Superior charcoal, $25.50 to $26.

Michigan Mineral Statistics.

The fourth annual report of Geo. A. Newett, of Ishpeming, Mich., as Commissioner of Mineral Statistics for the State of Michigan, has come from the press recently. It is regrettable that this is the last of Mr. Newett's reports, the exigencies of politics rather than the efficiency of the service controlling in appointments of this character. The commissioner has given his State a report of magnificent proportions and invaluable in the thoroughness with which it presents the status of iron and copper mining operations in the upper peninsula. It is unfortunate that a State so rich in minerals should pursue so parsimonious a policy with respect to their literature. The commissioner has a salary of $2,500 a year, from which he pays for the printing of his report and defrays all his expenses. As Mr. Newett points out, this arrangement puts a premium on a scant report and the printing of a small number of copies. Pride in the work has led the present commissioner to prepare and print the voluminous reports that have marked his incumbency. With only greater emphasis than before we can speak of the volume for 1898 as in the highest degree creditable to the author, who again has put the mining interests in his State and the hundreds of investors outside of the State under obligations to him. Mr. Newett estimates the market value of the minerals produced in Michigan in 1898 at $38,825 000, of which he credits $18,450 847 to iron ore and $16,834,670 to copper. He figures that if all the iron ore produced in the year in the State were made into a steel rail weighing 50 pounds to the foot, the rail would encircle the globe one and one-half times.

Mr. Winchell's Mesabi Estimates.

TO THE EDITOR:

It is always a pleasure to be able to say, "I told you so," and it is a far greater and rarer source of satisfaction to have others say it for one. Hence it is with no small amount of gratification that I read your remarks in *The Iron Trade Review* for Nov. 30 last, recalling some of my former predictions on the Mesabi range, and adducing proof of their correctness. Having been almost alone in early forecasts and appreciation of this greatest of all ranges, and having been at the time criticized quite severely by several eastern mining journals for my "exaggerated statements," I can never forget the support and confidence which I received from your journal, which was the earliest to recognize the true significance of the discovery of the new iron district, and the first to call attention to the fact that it was a blessing instead of a calamity to the iron trade of the whole country.

While it will be a long time before there is need of further great iron mines, and although long rail hauls will not be able to compete with water transportation, yet I believe the time will come when the states west of the Mississippi will be called upon to produce large quantities of iron ore. And I wish now to make the prediction, from experience and information gained in almost every portion of the western country, that Wyoming will be the scene of the next great development in iron mining. In no other part of the country have I seen conditions and ores so closely resembling those of the Mesabi and Gogebic ranges. HORACE V. WINCHELL.

Butte, Montana, Dec. 2, 1899.

THE Mossberg & Granville Mfg. Co., Providence, R. I., whose specialties are rolling mills, wire drawing machinery and dies and presses, has opened an office at Room 12, Mercantile Bank Bldg., Cleveland, in charge of George Richard Lamb.

CHAIRMAN FRICK RESIGNS.

(Special Telegram.)

PITTSBURG, Dec. 6.—The following statement has been given out concerning action taken by the board of managers of the Carnegie Steel Co., Ltd., at a meeting yesterday, for which Mr. Carnegie came on from New York:

"At a meeting of the Carnegie Steel Co., Ltd., Tuesday, Mr. H. C. Frick informed his partners of his desire to give up the duties of chairman of the board of managers, and asked to be relieved in order to join Mr. Carnegie, Mr. Phipps and Mr. Singer as consulting partners of the company. Mr. Frick's partners assented to his request. A successor to Mr. Frick was not chosen, as it is intended to abolish the office of chairman since Mr. Frick leaves it. Mr. H. M. Curry, who has long been confined by illness, sent his resignation as a member of the board, which his partners were forced to accept with great reluctance. Mr. George Lauder and Mr. A. M. Moreland were unanimously elected to fill the vacancies."

Mr. Frick has signified no intention of resigning as chairman of the board of managers of the H. C. Frick Coke Co., and will remain in Pittsburg.

LAKE SUPERIOR IRON MINES.

It is announced from Duluth that the Duluth, Missabe & Northern Railroad will build a new ore dock this winter, making three in all. Plans have not been made public, but it is stated that the dock will be the largest on the lakes, and make Duluth's storage capacity greater than that of any other port. The work will be done by the Barnett-Record Co., of Minneapolis.

The docks at Duluth, Two Harbors and Superior broke all records for November ore shipments last month. The D. M. & N. road shipped 603,978 tons over its docks, the heaviest month in its history apart from August. The Duluth & Iron Range record at Two Harbors was 440,675 for November, and the Eastern Minnesota dock on Allouez Bay shipped 72,718 tons. The total for the three is thus 1,117,371 tons. It is fair to assume that the Ashland, Marquette, Escanaba and Gladstone total is nearly if not quite as great as that for the Minnesota shipping ports. This would mean a total to Dec. 1 of fully 17,500,000 tons.

The Fayal mine has passed the 1,000,000-ton mark, and will make a total close to 1,150,000 tons.

At the Oliver mine double crews are at work stripping and moving aside low-grade ore. The latter is now piled up for future shipment instead of being thrown upon the dump.

The Lake Superior Consolidated Mines has secured additional iron land leases from the Rust, Goff and Burrows parties of Saginaw to lands near its present Hibbing mines, the new leases requiring a royalty of 25 cents a ton and a minimum of 100,000 tons yearly after January 1 next. Prior to the date the royalty is 30 cents on 20,000 tons. A lease has also been secured to the small portion of the Ætna mine, beside the Mountain Iron, fee to which was not already in the hands of the company. This is also a 25-cent lease, with a minimum of 100,000 tons a year.

AT Racine, Wis., officers of the National Founders' Association and of the striking molders had a conference last week in the effort to settle the strike in several Racine foundries. The men were ordered back to work by their national officers pending the settlement. The employing firms have answered the men that they cannot grant the advance asked, and time has been granted for further consideration of the matter.

THE plant of S. Morgan Smith & Sons, York City, Pa., is to be enlarged by the erection of a boiler shop, 230 x 160 feet.

THE Susquehanna Iron Co. has decided to build a wrought iron pipe mill at Columbia, Pa., at an outlay of $800,000.

THE National Coopers' Association has been holding its annual convention in Pittsburg this week. Tuesday night the members were given a banquet at the Hotel Henry by the American Steel Hoop Co.

'PERSONAL.'

The resignation of A. J. Singer as secretary, treasurer and director of the Universal Construction Co., of Chicago, and of E. A. S. Clarke, as director of the company, were presented and accepted at a meeting of the directors held last week. The positions were filled by the election of T. J. Hyman as secretary, treasurer and director, and of T. W. Robinson as director. Mr. Hyman is secretary of the Illinois Steel Co., and Mr. Robinson is general manager of the same company. We noted recently the resignation of E. A. S. Clarke as general manager of the Illinois Steel Co. Mr. Clark will spend the next few months abroad, and it is understood will then become general manager of one of the leading agricultural implement manufacturing companies of Chicago.

The names of several persons familiar to the iron trade appear in the list of newly elected directors of the Manhattan Fire Insurance Co., of New York: Frank Rockefeller, of Cleveland; C. N. Schmick, of Leetonia, O.; and J. E. Brown, president of the Aultman-Taylor Mfg. Co., of Mansfield, O. Mr. Schmick, who is president of the First National Bank of Leetonia, has retired recently from active connection with the Cherry Valley Iron Works. Referring to his election to the Manhattan Fire Insurance Co. directory, the *Financial Review*, of New York, says: "Mr. Schmick has been conservative during his business life, and in those enterprises with which he has permitted the association of his name he has been highly successful. His selection for the directory is therefore a move which will meet with general satisfaction here as in his own State of Ohio."

F. E. Thompson, assistant superintendent of the Bessemer department of the Cambria Steel Co., recently gave a very interesting paper on "Steelmaking of Today," in a popular lecture course at Johnstown, Pa.

Working on a Sheet Mill Consolidation.

The sheet manufacturers have been at work for a short time on a plan to consolidate their interests by their own efforts. A committee composed of J. G. Battelle, president of the Association of Iron and Steel Sheet Manufacturers; president and general manager of the Piqua Rolling Mill Co.; secretary and general manager of the Cincinnati Corrugating Co., and treasurer of the Midland Steel Co.; A. W. Brown, vice-president and general manager of the Cambridge Iron & Steel Co.; and B. M. Caldwell, general manager of the Ætna-Standard Iron & Steel Co., has been at work conferring with the individual manufacturers, and it is announced that when this committee has completed the preliminary work a general meeting of the sheet manufacturers will be called to act on a proposition. It is not regarded as probable that anything can be done, as it is generally felt that such consolidations must necessarily be managed by persons not connected directly with the trade.

THE Union Iron Works Co., Selma, Ala., is in the market for a 12 inch slotting machine, one universal milling machine, and one second-hand boring machine to take car wheels as large as 26 inches.

IN announcing the 93rd meeting of the Foundrymen's Association of Philadelphia, Wednesday evening, Dec. 6, for which W. C. Henderson prepared a paper with 20 lantern slides, on "Kryolith," Secretary Evans makes this statement to members: "A credit bureau of information has been established in this association. Should you have unscrupulous customers who fail to pay their bills, but who take their patterns away and have their castings made elsewhere, this association will look after a case of that kind."

JULIAN KENNEDY, of Pittsburg, is drawing plans for a slabbing mill for the Mariopol Mining & Metallurgical Co., Mariopol, Russia. Contracts for equipment have been placed amounting to about $200,000.

George W. B. Taylor, of N. & G. Taylor Co., tin plate manufacturers, of Philadelphia, died in that city Nov. 26, of heart disease. He was 49 years old.

THE IRON TRADE REVIEW
AND
INDUSTRIAL WORLD.

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DECEMBER 7, 1899.

SIGNS OF STRENGTH PERSIST.

In the past six months the iron trade has gone up and down the question of the probable life-time of high-level values often enough to be entitled to some light. And some illumination has been vouchsafed—enough to make buyers and sellers so bold as to make contracts extending up to the middle of next year, nearly seven months beyond the present date. Some few have bought pig iron for all of 1900. In finished material contracts have been entered into running ahead one month, two months, in many cases six or seven months, but comparatively few, apart from rails, reaching into the second half of next year.

The beginning of the quiet time of the year is now upon the trade; but it finds producer and consumer alike unwilling to treat it as an ordinary, average quiet time and nothing more. On the one hand is a class who fear that the present quietness may be misinterpreted; that forgetful members of the trade may fail to recall how there has generally been a slowing down in December, particularly in finished lines, and may thus be led to think of this month as the beginning of the end of the good prices from which many are just beginning to benefit. It is pointed out that this view may lead to postponements awaiting a lower level, and later may bring buyers into the market at once in a way that will push prices even higher.

Another expression of the solicitude that crops out when all eyes are on the market, is the fear of what the constitutionally weak seller may do by letting his temperament, his vivid recollection of conditions recently past, and his habit of thought concerning booms, determine his policy, rather than substantial, underlying facts whose manifestations are not so obvious or so plentiful at the moment. To such an extent are some members of the trade persuaded that sentiment eventually makes conditions, that they fear the misinterpretation of ordinary market statements.

It needs to be remembered that sentiment and temperament and opinion will be no more influential now, when there is a lull in the struggle to get material from the mills, than it was eight months ago, when prompt disaster was predicted from prices representing only a fraction of the advance actually made. Surface indications are often far from trustworthy. In the mind of the general public the iron trade has just been through eight months of unparalleled profits, and is at the climax of the movement. Iron and steel manufacturers feel assured, however, that the greatest year in twenty is just ahead of them.

Who in the trade expects to see wages reduced in 1900? Momentum has scarcely yet been acquired by the additions of from 10 to 40 per cent in the earnings of American wage earners in the past year. It will be well along in 1900 before the wave of prosperity to the volume of which every workingman's home has added, can have reached high tide.

Concrete statements concerning the factors in the iron situation, on the side of supply and demand, have been threshed over and over: the effect of high prices on buying; the large increase in production in the past half year; inability to push export trade; the certainty that the reaction is hastened by each successive advance; the recession of certain prices, as of plates, from the disproportionate positions attained under a sudden, outbreaking demand. But that the climax of the present prosperity has been reached cannot be asserted from anything yet developed. Nor is there in the passing phases of the market in these quieter weeks, that which can be regarded as an index to generally reactionary conditions.

THE PITTSBURG FOUNDRY TROUBLE.

The history of the difficulty between the Pittsburg machinery molders and their employers, just ended this week, does not furnish matter for congratulation to those who earlier in the year hoped for so much from the negotiations between the national bodies of employers and employes. It is true, the great principle of arbitration, which triumphed in the formulation of the New York agreement, has been employed to a greater or less extent in the settlement of a number of strikes in the foundry trade; but during the recent past much has come up to show that a great deal of work remains to be done. We referred three weeks ago to the evidence furnished by the Detroit conference that the national bodies were still far apart on a number of vital questions. The difficulties at Pittsburg have given proof that even the principles subscribed to by the national bodies may not be followed in individual cases.

The first open act of the Pittsburg molders in this difficulty clearly showed a sentiment opposed to the arbitration and conciliation principle. On Tuesday, Sept. 26, the employers were notified that the men would go out on strike the following Saturday if their demands were not granted. Before this Tuesday there had been no general conference, and the shortness of the time given the employers to accede to the demands showed plainly that the men courted settlement by a strike. But one con-

ference was held between Tuesday and Saturday. This was ineffective, and the men went out. The molders claimed that as many of their number were not members of the Iron Molders' Union of North America, they could not be bound by the New York agreement; but as this agreement had been entered into by that body, not as a concession to the employers, but as a mutually advantageous affair, the point was scarcely well taken. When the strike had lasted about three weeks, a period greater than the men had expected, a conference was asked for by Joseph Valentine, the national vice-president of the Iron Molders' Union. An agreement resulted, which was regarded as fully in line with the New York agreement, viz., that the men return to work under former conditions and the matter be referred to a conference between representatives of the local bodies of employers and employes; and in the event of a disagreement there, to an arbitration board of the national bodies, whatever advance might be granted being taken as retroactive.

When the local committees failed to agree the matter came, therefore, before an arbitration board composed of five representatives from each of the two national bodies, the National Founders' Association and the Iron Molders' Union of North America. The employers' representatives went to the meeting in the full belief that it was to be that of an arbitration board. Certain concessions were made by them, when it was found that the molders' representatives were not prepared either to accept these or any other concessions as final, or to choose an umpire to decide the matter. They represented that they could do nothing but refer these concessions to a mass meeting of the men. Not only was this a plain repudiation of the principle of arbitration, but it gave room for well founded claims that the men had acted in bad faith, in that the employers had had reason to expect that the joint body was to act as an arbitration board.

These negotiations resulted in a complete failure, and after a presentation of their original demands, the men last week went out, but not in as great numbers as before, since a number of employers had made concessions to their men, who remained at work. In no case, as we learn from the most trustworthy sources, were the full demands of the men granted. This week practically all of the men have returned to work, and the incident is closed for the present, with both sides claiming a victory.

There is room for discussion as to how much has been gained on either side in the contest. The men have secured their demand, *per se*, of a minimum wage rate of $3 a day. To make this effective, however, they should have secured an agreement that all should be taken back to work and kept at work. This they did not have. No agreement at all has been signed by any of the employers. One of the terms on which the founders had agreed to arbitration was that a contract should be signed with each man for a year. This would have made the $3 minimum really effective, if the arbitration board had decided for it. The men lost also, in connection with their practical refusal of arbitration, the provision that the new wages should be retroactive. Counting these two features in connection with the loss of practically a month's time, it may be said that the honors or otherwise of the conflict have been equally divided.

The contest at Pittsburg, on the part of the employers, was based mainly on a desire to follow the spirit and letter of the agreement regarding arbitration by the national bodies. The matter of the actual rate of wages to be paid was really a minor consideration. The foundrymen fully appreciated the prosperity they were enjoying mutually with their men, after a long period of dullness, and desired above all things to avoid a cessation of operations. As has been too often the case with labor, the men did not appreciate the value of the prosperity they were enjoying.

It is reasonable to believe that this affair at Pittsburg will furnish an object lesson to the foundry trade at large which will in the future assist the cause of arbitration between the national bodies. It is a clear-cut case of the men having secured, on the surface, the main thing for which they contended, an advance in wages and the establishment of a minimum wage, while all that they would have secured by submitting to arbitraion with a responible body, they have lost. They have now no agreement, written or otherwise, regarding their retention in employment for any definite time, they have lost a month's time entirely, and they have lost the advance for another month. The molders may find, to their surprise, that the first of these losses will prove the most important. The spirit of trade unionism has ever been a leveling one, the bringing up of inferior workmen to the same level, as regards wages, with their superiors. Labor leaders have emphatically disclaimed any such intention, but results have spoken nevertheless. With agreements on the part of the foundrymen to keep men in their employ, the enforcement of a minimum wage rate, even if lower than the one now recognized, might have constituted a greater advantage than has been gained.

THE employes at certain ore docks on Lake Erie have capped the climax of the past season's disturbances by striking against the loading of dock ore by the use of steam shovels. In one instance it is demanded, not only that hand labor be employed altogether in loading ore for winter shipment, but that the steam shovels be removed from the dock, to preclude their use in any emergency. There will be no two opinions on the proposition that the benefits of prosperity find a very large offset in the unreasonable and oftentimes seemingly vindictive demands of labor. In the past season the seed has been sown for a large crop of troubles; and if the spirit that has been evident in the attempts to handicap employers is returned in kind, the end will be long postponed. There has been fair talk of arbitration and conciliation, but the action taken has spoken too often of bitterness and malevolence. We confess that the outlook for the coming year is far from optimistic.

THE McGugin Iron & Coal Co., Olive Furnace, O., has been incorporated with $150,000 capital.

THE WEEK IN IRON AND STEEL STOCKS.

Denison, Prior & Co. say in their weekly letter on the iron and steel stocks: "The President's message was construed as a bearish argument on the industrial list, and that, combined with the very apparent discrimination against the non-dividend-paying industrials, had the effect of making Tuesday's market a comparative field day for the bears. Money will not ease, and a bull market and a tight money market make a very rare combination. We had hoped that money would be easier during December, but the pessimists have the better end of the argument. The West continues to hold its money profitably employed in commercial lines. The European markets are experiencing a veritable stringency, and New York is calling loans in anticipation of the January disbursements. For these reasons we are forced to admit that a bull movement is more a fancy of the future than a possibility of the imediate present.

"We call attention to one gratifying fact—the steadiness of the preferred issues of the iron and steel consolidations. Even the decision in the celebrated Addyston Pipe case failed to affect them. This decision has been taken up by the bears and will be used for all it is worth. As a matter of fact it has no more bearing on the present crop of "trusts" than it has on such an organization as the New York Central & Hudson River Railroad Co."

Fluctuations of the Week and the Year.

The following table shows the fluctuations in iron and steel stocks for the week ending Dec. 5:

Name.	WEEK.				YEAR.			
	Open	High	Low	Close	High.		Low.	
Am. Car & Fdy.....	17	17⅛	16	16	27⅜	May 25	15	June 15
Am. Car & Fdy pr.	62	62½	61½	62	68¾	Sept. 7	56⅜	June 16
Am. Steel & Wire..	49¾	50	47⅞	47¾	72	May 4	45	Feb. 8
AmSteel & Wire pr	95⅛	95½	95	95¾	106¾	Mar. 13	92½	Feb. 8
Am. Steel Hoop.....	47½	48¾	46¾	46¾	48¾	Nov. 29	24	May 24
Am. Steel Hoop pr	85	85⅝	84⅛	84½	86¾	Sept. 14	70	May 13
Am. Tin Plate.....	34¾	34¾	32½	32½	52¾	April 4	31⅛	Nov. 10
Am. Tin Plate pr..	84	84	83	83	99⅜	Feb. 8	81	June 8
Col. Fuel & Iron...	52¾	56	52½	54⅛	64	Sept. 11	30⅛	Feb. 8
Federal Steel.....	60	63¼	59⅜	61¾	75	Apr. 3	46⅜	Feb. 8
Federal Steel pr....	81⅛	82⅜	81	81	93¼	April 3	72½	May 13
National Steel.....	48¾	49¾	46¾	47	63	April 24	43¾	June 2
National Steel pr..	95⅜	95⅞	94⅞	95	99¾	Aug. 11	85	May 15
Pressed Steel Car..	59¾	59¾	58	58	61	Aug. 14	44¼	June 1
PressedSteelCar pr	89⅛	90	89¼	89¼	91	Sept. 7	78	May 25
Republic Steel.....	25	26½	24½	24⅝	33⅞	Sept. 6	22¼	Aug. 26
Republic Steel pr..	71	71¾	70¼	70¾	79	Aug. 29	69	Nov. 6
Tenn. Coal & Iron	115¾	116¾	113⅜	113⅜	126	Sept 11	36	Jan. 14

Notes.

The prospect of a dividend on the common stock of the American Steel Hoop Co., next spring, is causing some activity in this stock. The statement that the remainder of the preferred dividends for the fiscal year would be anticipated, so that dividends on the common might start early in 1899, is pronounced entirely unauthorized.

Jan. 1 is the date of the payment of the next quarterly dividend of 1¼ per cent upon the preferred stock of the National Steel Co., as well as of the Republic Iron & Steel Co.

President Gary gave out the following statement last week concerning the Federal Steel Co.: "The directors practically decided at their last meeting that at the meeting to be held Dec. 12 they would declare a dividend of 3 per cent on the preferred stock. As to the common stock, the directors haven't yet considered the question excepting that last June they declared a dividend of 1¼ per cent, which was enjoined by the court and the money was then set aside. They cannot declare any dividend upon the common stock until the end of this year. Our earnings are satisfactory and the prospects for next year are very much better even than this year. The Minnesota Iron Co. will next year produce about 3,500,000 tons of ore. The price for this ore has been fixed at $5.50 a ton. The price this year has been $2.50 to $3 a ton. The Duluth & Iron Range railroad will haul during this year about 4,000,000 tons, but next year about 5,000,000 tons. Our steamship lines will carry next year upward of 2 000,000 tons. The rate this year was 80 cents a ton, for next year it has been fixed at $1.25 a ton The company will manufacture 1,500,000 tons of coke next year, as against 750,000 tons this year. The price at the ovens this year was $1.50 a ton; next year the price will be from $2.75 to $3 a ton. It will manufacture upward of 2,000,000 tons of finished product, for which the price has increased over this year from 75 per cent to 100 per cent a ton. Of this product we have already contracted to sell about 1,400,000 tons next year."

THE SELLING SIDE OF THE TRADE.

Representatives of Well Known Iron and Steel and Equipment Firms.

Mr. Schwarzenberg's family name has been associated with the old metal trade in Cleveland for many years. In 1865, when thirteen years old, he began work at his father's warehouse on the river front, this being the pioneer Northern Ohio establishment, many serving an apprenticeship there who afterward embarked in the trade. In 1873, Henry L. Schwarzenberg went into the Pennsylvania oil district, and several years later returned to Cleveland, continuing in the old iron and metal trade. The business often reached a million dollar

HENRY L. SCHWARZENBERG.

total in a year on a tonnage that at the prices of recent years would make but a fraction of that amount. Mr. Schwarzenberg is still a dealer in old metals, and in addition has the general sales agency for R. B. Seidel's plumbago crucibles. He also represents the Nassau Smelting & Refining Works, of New York. His acquaintance is one of the largest of those engaged in similar lines, constant traveling being necessary to keep in touch with the trade. Mr. Schwarzenberg's office is at 407 Cuyahoga Bldg., Cleveland.

Obituary.

John I. Blair, whose name has been connected with so many railroad enterprises, died at his home in Blairstown, N. J., Dec. 2, aged 97 years. In the latter part of the last century his great grandfather, Samuel Blair, was in charge of the iron works at Oxford Furnace, N. J. His father lived at Delaware, N. J., where he had charge of the shipment of iron from the same furnace. John I. Blair, as his fortune grew, its foundations being laid in the operation of general country stores, devoted himself to the encouragement of the iron industry at Oxford Furnace, where operations had been going on dating from Penn's settlement in Pennsylvania. For the transportation of the metal to the seaboard Mr. Blair and others organized the Lackawanna Coal & Iron Co., out of which grew the great system of the Delaware, Lackawanna & Western. Mr. Blair's name was connected, either as builder or director, with no less than 25 different railroad lines, chiefly in the West. He was a delegate to all national conventions of the Republican party but the last two. He made large gifts to the Presbyterian Academy of Blairstown and to Princeton and Lafayette Universities. To the Presbyterian church he gave fully $500,000.

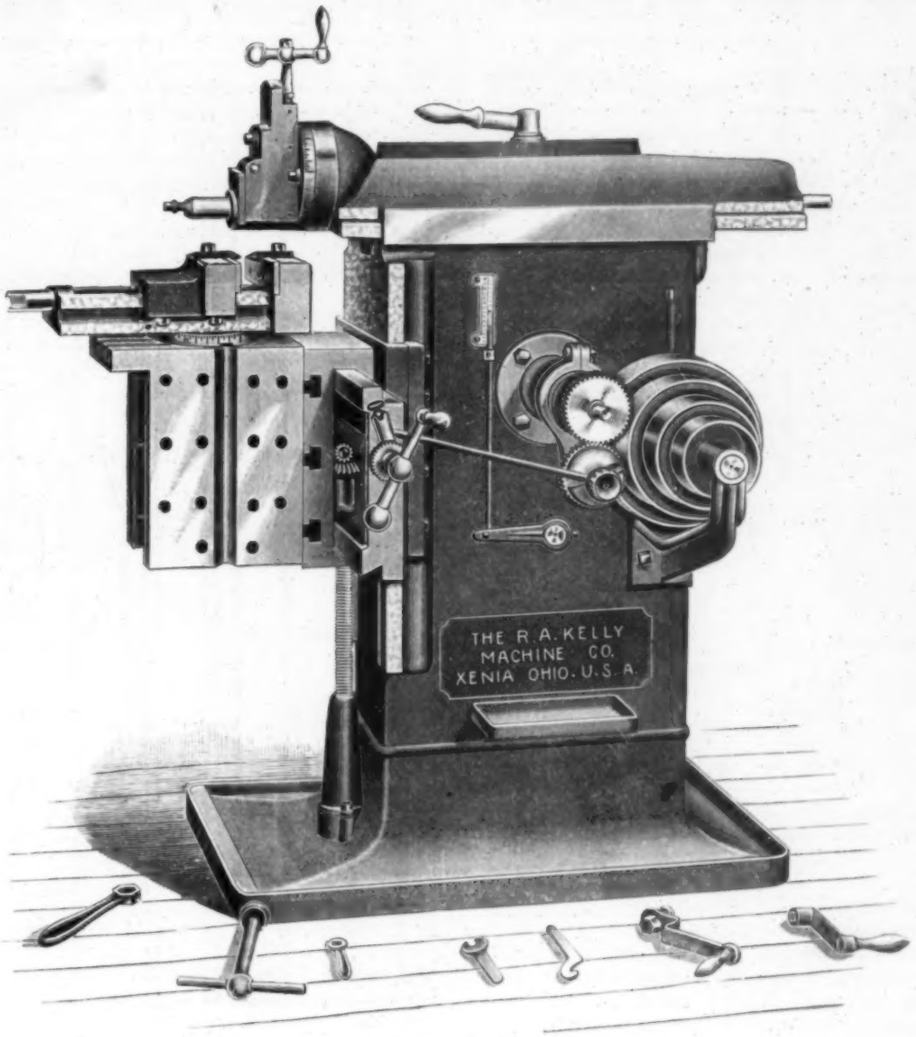
SIXTEEN-INCH CRANK SHAPER.

To its 15-inch and 20-inch adjustable crank shapers the R. A. Kelly Machine Co., of Xenia, O., has added recently a 16-inch shaper, of which a view is given in the accompanying illustration. The Kelly shaper was designed for planing small parts of machinery and tools of various shapes which cannot with economy be worked on a slow-running planer. The bearings are fitted and scraped to a perfect surface plate.

The ram has a long bearing surface even if put to its full stroke, and will not spring or give under the heaviest cut. The table, which is of box pattern, has horizontal T slots on the left hand side of the machine for bolting to the table the different classes of work which cannot be held in a vise. The right hand side has beside two vertical T slots a V-shaped groove in the center, enabling the operator to bolt a shaft or any other cylindrical piece of work to be planed while held in an upright position. A slot is planed horizontal on the same side to put on the vise. The table can be detached from the machine and work bolted direct to the apron, which is desirable where heavy pieces have to be planed. The cross-rail or cross-head is made long, so as to give the table sufficient travel. The apron has a dovetail slide on the bottom where it is connected with cross-rail. The cross-feed is positive and easy in operation.

A change of stroke can be made while the machine is in operation. The makers' patented crank motion consists of a rack and wrist, made of the best cast steel, sliding on the surface of a perfect cut gear and changed from the outside. Attention has been given to bringing the crank, which transfers motion to the rocker arm, as high as possible, giving more than usual power to the ram while taking a cut. These shapers have an extra wide base, giving correspondingly greater space between the bolt holes and thus greater rigidity, and at the same time are reinforced on the back to secure greater strength.

The 16-inch shaper has a heavy base, covering ample floor space to secure solid bearing and smooth running. The base has a lip around the edge to catch oil and chips, and is reinforced and strengthened by ribs on the under side. The frame has strong, wide bearings for the ram and cross-rail. The latter is long and deep. The table is of box form with extension top. Means are provided to support the table while taking heavy cuts. The vise is provided with centers for holding round or irregular shapes while being operated upon. The ram is of semi-circular form and very stiff. The stroke plate is placed near the top of the frame so that the length of the stroke may be seen at a glance.



SIXTEEN-INCH CRANK SHAPER.

The three Isabella stacks of the American Steel Hoop Co., at Etna, Pa., will be enlarged and greatly improved, but the report that a fourth stack will be erected is incorrect.

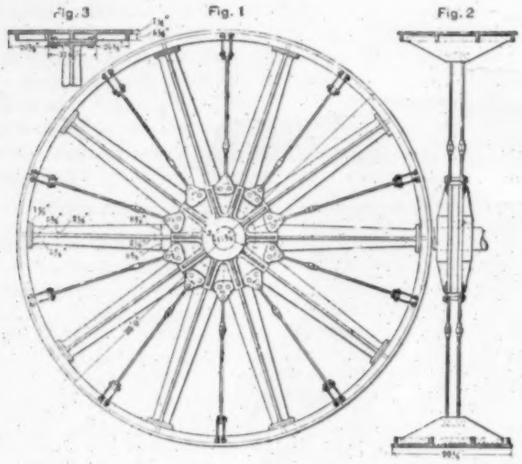
A riveting machine with a pressure of 125 pounds to the square inch is being installed at the Pennsylvania Co.'s shops at Altoona, Pa.

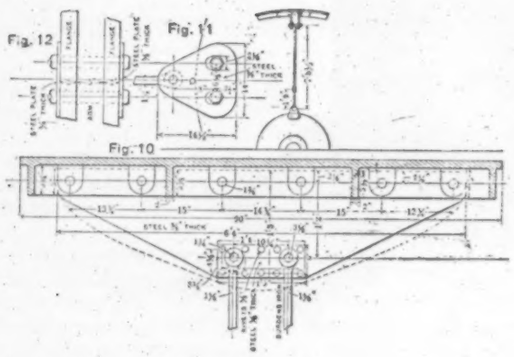
The Globe Machinery & Supply Co., Des Moines, Ia., has equipped a large machine shop with an outfit of improved machinery and tools for the purpose of conducting a general jobbing and repair trade.

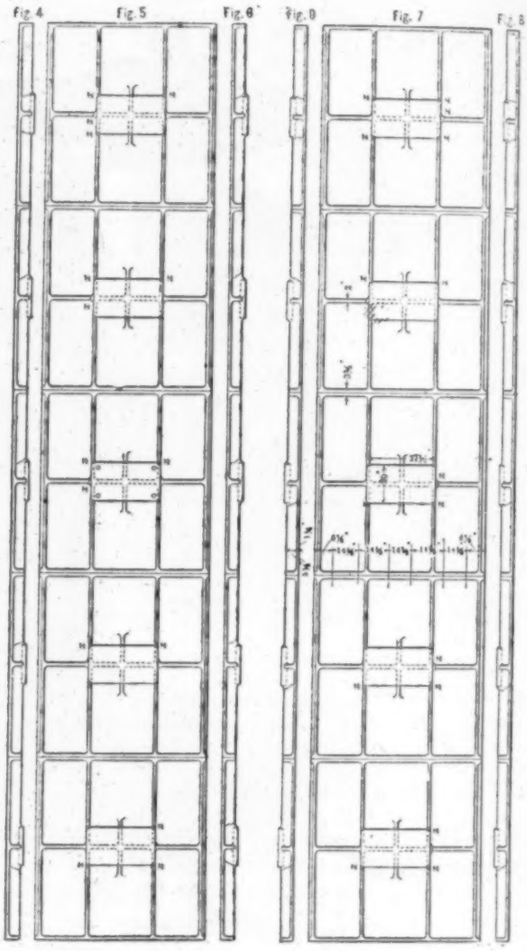
REPAIRING A BROKEN FLY-WHEEL.

BY JAMES M'BRIDE, BROOKLYN, N. Y.

This wheel was one of the band wheel type, weighing between 30 and 40 tons, was driven by a pair of Corliss engines 30 inches in diameter by 60 inches stroke, and ran 53 revolutions per minute, carrying two double leather belts, one 48 inches wide and one 34 inches wide. The rim was composed of ten ribbed segments attached to the arms at the center, and bolted together at their ends between the arms, each arm carrying one segment. The construction of these segments will be understood by referring to Figs. 4 to 9, of which 4 and 7 are views of each half of the wheel spread out flat and looked at from the inside. Four of these ribs, each 5½ inches deep by 1¼ inches thick, run around inside the rim, and are intersected at right angles by other ribs across the rim. Those at the ends of the segments making the flanges are







1½ inches thick, and those extending out from the arms are 2 inches thick. The segments are bolted together with six 1¼-inch rough bolts in a cored hole 1⅞ inches in dimeter, and through each pair of flanges there are two ⅝-inch steel dowel pins. The segments are secured to the arm flanges by four 2¼-inch bolts, and the arms are secured to the hub, each with two 2¼-inch bolts through the hub flanges.

It will be noticed by reference to Fig. 3 that there are really three wheels in the width of this broad rim (90 inches), and that only the center one, 37½ inches wide, gets any material support from the arms.

As this was the method of building broad rim band wheels some years ago, and as there may be others who are troubled with the fear of such wheels going on a "bust," the writer, for the benefit of such, has decided to tell how he repaired this one that was badly broken. The wheel was erected early in 1885 and ran until 1889, when an accident to the governor permitted the engines to run away with it. It is not known what speed they reached, but it was found upon examination that a number of cracks had appeared in the ribs, located as shown by the crosses on Figs 4 and 7.

There were 31 of these cracks, and it will be noticed that they are all located around where the segment is bolted to the arms. It has been suggested that some of these cracks may be due to shrinkage of the castings, but out of more than 200 other places on the castings where such shrinkage could occur, not one is to be found, nor were there any in the castings anywhere when the wheel was erected.

It therefore seems that these cracks must have been caused by the strains on the metal when the engines ran away, by reason of that part of the rim between the arms being forced out by centrifugal force due to high velocity, as this is just what would occur under such conditions.

Careful examination of these cracks during the last ten years did not show that they were extending, but the surface of the rim running out of true, and this untruthfulness being very much increased by increased speed of the engines at times when all the work was thrown off, it was determined to strengtheen the wheel, and, if possible, restore it to its true running condition.

As the wheel was in service 20 hours of the 24 each six days of the week, and as business would not permit a long stoppage, the writer devised the method here described:

Fig. 1 is a side elevation of the wheel; Fig. 2 is a cross section near where the segments are bolted together, and Fig. 3 is a cross section of the rim near the arms; Figs. 4 to 9 are flat and edge views of the rim, while the rest of the figures are details of the different parts on a larger scale. After completing the dsigns, it was thought best to submit them to some expert engineers in this line before proceeding with the work. Mr. Albert A. Cary, of this city, and Mr. James B. Stanwood, of Cincinnati, O., both members of this society, were employed to examine and report on the case. They

* Read at the New York meeting (December, 1899) of the American Society of Mechanical Engineers.

reported that the method submitted was the best one that could be used, and with certain modifications would make the wheel perfectly safe. Among their suggestions were the following:

1st. That the bolts for bolting the rim flanges together be enlarged; that the holes in the castings be reamed, and turned bolts used.

2d. That the outside steel flange plates should be made a true parabola, as shown by the heavy dotted lines on Fig. 10.

3d. That the tie rods take hold farther from the edge of the plates than was shown on the design.

The latter suggestion was adopted. The second one involved so much extra labor and expense, and the benefit to be gained was so small, that it was not followed; the method described and shown in Figs. 16 and 17 very nearly accomplishing the same result. The first suggestion would probably have been followed, only that it involved cutting away of much more of the engine-room floor (which is iron) and the removal of the railing around the wheel; hence it was decided to use plates of the shape originally shown. It was determined to fasten the segments to the hub of the wheel by means of flat steel plates ⅜ inch thick, one bolted on each side of the flange where the segments are connected, and by two iron tie rods with turn-buckles, and triangular plates fitted over the heads and nuts of the bolts, binding the arms to the hub. Figs. 10, 11 and 12 show the details of the fastenings to the hub and rim, while Figs. 13, 14 and 15 show details of fastening the tie rods to the plates. Figs. 16 and 17

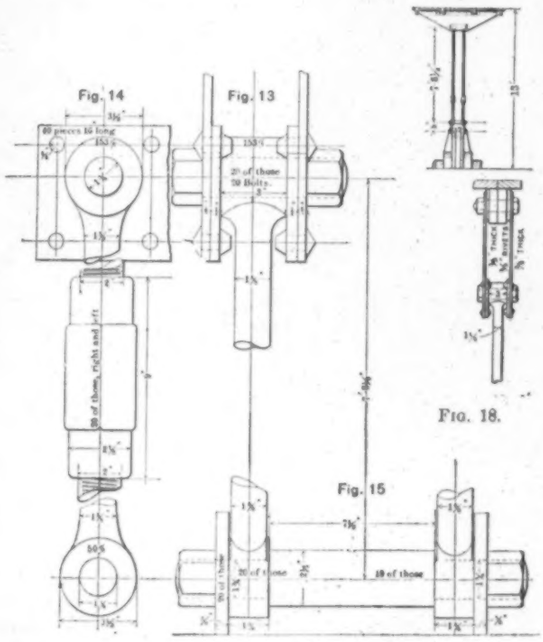


FIG. 18.

show method of fastening those plates to segment flanges by rough bolts.

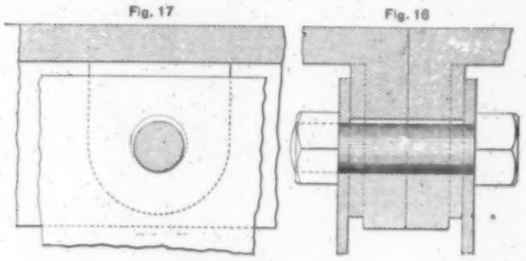
This last mentioned detail was a very important one on account of a rough bolt not fitting a rough hole, and as it was deemed impracticable to ream those holes and put in a turned bolt, the following method was employed to get a complete metal bearing on the tie rods from the hub to the rim: The bolts were removed from the segment flange, one plate laid to its place, and the holes marked on it 1¾ inches in diameter. The holes through the steel plate were to be only 1¾ inches in diameter, and were not drilled in the center of the marking, but so that the edge of the hole touched the side of the marking next to the center of the wheel, so that when the bolt was put in place it had a bearing on the flange next to the centre of the wheel and on the plate next the rim. This left no lost space to be taken up when the tie rods were tightened.

The triangular shaped pieces (Fig. 11) were punched so that they slipped neatly over the heads and nuts of the bolts on the hub, and marked and fitted close to the sides next the shaft. These plates were fitted in pairs, and held in place by a ¾-inch bolt passing through them just outside of the hub flanges. After being thus fitted and held in place, the center of the bolt holes for the ends of the tie rods were laid off by correct equal measurements from the centers of the flange bolts and from the side of the shaft.

These plates are held apart by a separator 2½ inches in diameter, with the ends turned down to take the eyes of the tie rods and plates, and are held by nuts on each end, as shown in Fig. 5. The outer ends of the tie rods are secured to the steel plates at the rim by eyes and turned bolts, as shown in Fig. 10, the holes being reinforced on the inside of the plate by smaller plates ¼-inch thick. One plate of each pair at the rim was marked from segment flange, and its mate bolted to it and both drilled together.

To mark off this work, and to put it back in place when finished, advantage was taken of the hour four times a day when the engines were stopped; the parts on the hub being put back as they were finished, until all with the short ends of the tie rods were in place, these parts being so light and near the center of the wheel, as not to throw it materially out of balance.

A different method, however, had to be adopted with the parts which were attached to the segments. These were fitted in pairs diametrically opposite the wheel, and when ready were put in place in this order, thus always keeping the wheel in balance: After all the parts were in place and the tie rods slightly tightened, a surface gauge was placed on the floor somewhat below the center of the shaft, with the pointer touching the rim opposite the tie rods. The wheel was then turned until the end of the nearest arm came opposite the pointer; the distance between the end of the pointer and face of wheel was noted, and the wheel turned back to its first position, and the tie rods tightened until the noted distance appeared between the pointer and wheel. Each part opposite the tie rods was thus treated, and the wheel gone over twice, when it was found that the rim, from the center out toward the edge as far as it was supported by



the flange on the arm, ran as true as when the wheel was erected, and on the edges of the rim where the plates took hold, nearly so; while the edge of the rim out from the arms did not run true, because the cracked ribs at these points allowed the rim to spring out, and could not be brought back by the tie rods.

Nothing has been said about calculating the strength of the various parts, but they were all based on the assumption that all that part of the rim lying between any two arms was entirely broken loose from the rest of the rim, and its centrifugal force at normal speed held by the two tie rods. These tie rods rods were of dimensions to sustain this load with a factor of safety of nearly 5 to 1, and the strength of all other parts was based on this factor. The total weight added to the wheel was about 3,700 pounds, and the total cost of repairs, labor and material less than $500. For the method of attaching the triangular plates to the hub of the wheel by fitting over the heads and nuts of the flange bolts, and for the separator for holding plates and tie rods, I am indebted to Mr. John Young, of Watts-Campbell Engine Co., of Newark, N. J. To my foreman machinist, Mr. E. H. Thomas, I am also indebted for many valuable little kinks which have done much to further the work, and in conclusion I will say that the wheel is now stronger than when first erected; that it was not touched with the edge of a chisel nor the point of a drill, and that not a working hour of the engines was lost during the repairs.

The Mahoning Foundry & Machine Co., of Youngstown, O., has organized under a new charter. The following officers have been elected: F. D. Runser, president; Mason Evans, vice-president; F. G. Evans, secretary and treasurer.

THE COMET GYRATORY CRUSHER.

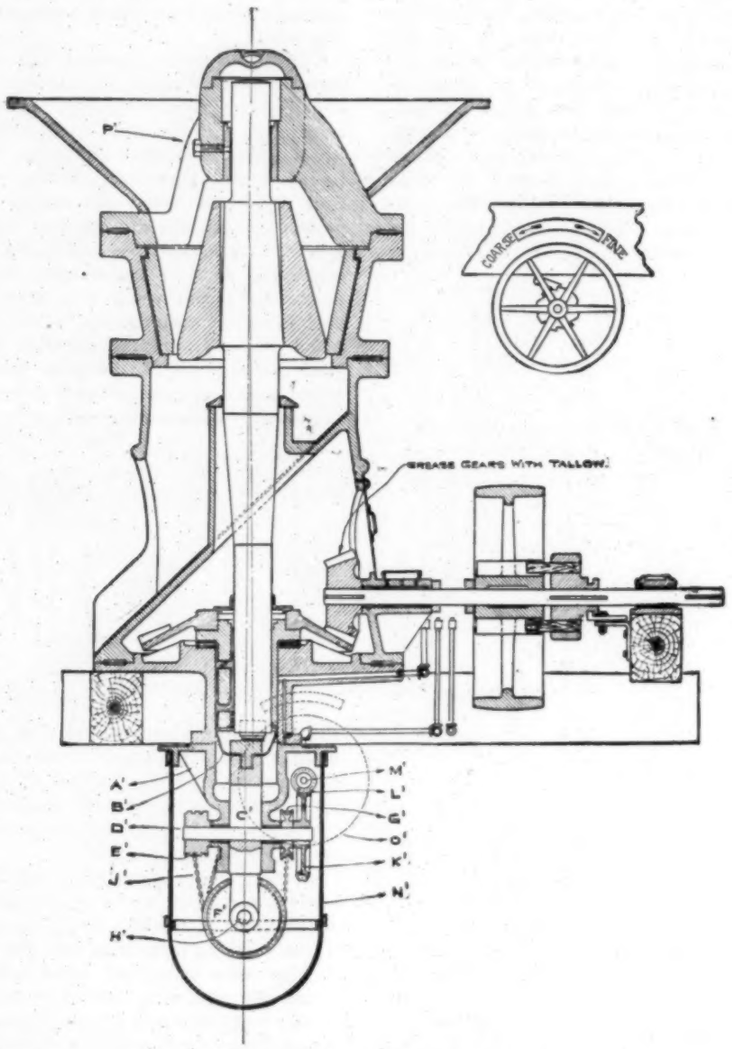
As compared with the performance of rock crushers of the jaw type, the record of the Comet gyratory crushers of like weight manufactured by Fraser & Chalmers, shows, it is stated, a considerably greater capacity. In view of the recognition given the Comet crusher by the miners of certain Lake Superior ores that need to be crushed to reduce them to sizes convenient for the blast furnaces, some details of their work will be of interest:

For example, a size C reducing hard quartz to a 2-inch ring and under, puts through 500 tons a day at a well known Idaho mine. Its weight is 18,300 pounds. It displaced two 9-inch by 15 inch jaw crushers each weighing 16,900 pounds. Weight for weight the capacity of the Comet was double. The cost of wear and repairs was less. One of the jaw crushers in question is rated to be of a capacity of eight tons an hour, or 192 tons in 24 hours, while the Comet C is rated at 15 to 30 tons an hour, or 360 to 720 tons in 24 hours. In other words the Comet was not fed up to its capacity, while the disinterested mill man got the most he could out of the two jaw crushers. In larger sizes of any desired capacity manufacturers claim that the comparison as to weight is more favorable to the Comet, as the framing of the straight jaw machines has to be inordinately heavy to resist the strain imposed. The largest Comet is capable of crushing two or three tons a minute. Theoretically we have in the straight jaw machine an intermittent action while the Comet gives a continuous crushing around a cone of circular section. Referring to strength, attention is called to the fact that the straight jaw machine has flat members while the Comet has one central fulcrum capable of resisting to the limit of integral strength of the steel or chilled iron of which it is composed, and the enclosing ring, in which any surface stress is backed and supported in the best form possible.

If a piece of the hardest hematite of a flattened and elongated form as is not unusual, gets into a flat jaw crusher, the jaws have no alternative but to crush the solid mass at one stroke. With the Comet crusher such a piece is shattered by cross breaking, furnishing a good example of a lever of the first order, with the cone as fulcrum.

The details of the Comet adjustable crusher are shown in Fig. 1, presented herewith. The work they do is as severe as any that steel and iron are called upon to perform. While running, the cone can be moved up and down with an easy adjustment so as to vary the size of product. It is not necessary to stop the machine and screw or shim it up. The adjusting gear is always ready and by means of it the wear on the heads and liners can be equalized to promote the endurance of these severely tried wearing parts. The stresses imposed on the bearings are severe, and good oil and lubrication are of prime importance. Fraser & Chalmers recommend a superior fire-proof oil which has given satisfactory results in practice. Where cool bearings are so important and stresses are so severe the manufacturers have considered it the best engineering practice to make bearings ample. The driving shaft is given two good bearings. Overhung bearings have been tried without the outboard bearing, and trouble has resulted despite extra efforts to keep the single bearing from heating and cutting. It is a poor point at which to economize bearing surface, and as a substantial outboard bearing is a good means of securing immunity from trouble it is considered unwise to abandon it.

The method of adjustment will be made clear by a refer-



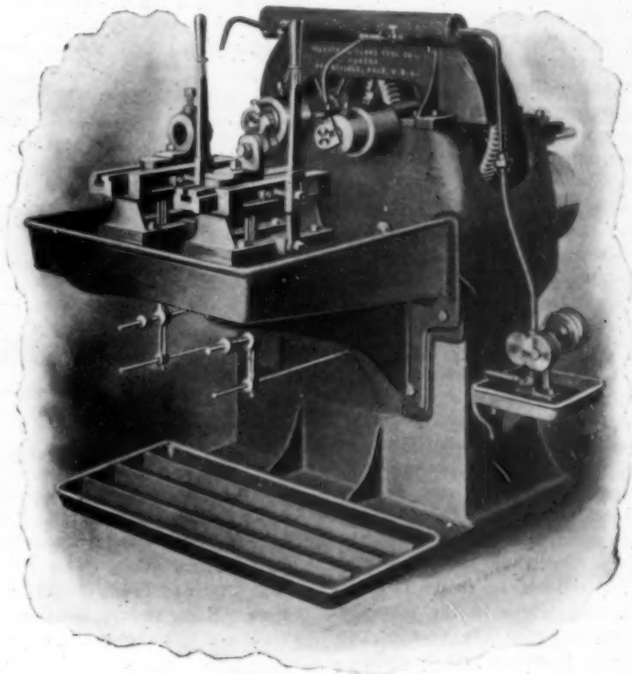
THE COMET ADJUSTABLE CRUSHER.

ence to the cut. Turning the hand wheel O from left to right will raise the spindle and crush fine; turning the hand wheel from right to left will lower the spindle and crush coarse. Ratchet and pawl are provided immediately behind the wheel and prevent the hand wheel moving from jar. The sheaves F are mounted on the end of a vertical moving ram C, to carry chain for raising and lowering the ram. This ram has a slot so as to allow the shaft of the worm wheel K to work freely through it. At the upper end of the ram is a brass cup shaped bowl filled with oil, providing necessary lubricant. This cup moves up and down with the ram, carrying the oil with it. On the end of the ram are the ordinary button and toe, on which the spindle rests. In lowering the ram the spindle follows it in passing through the driving bevel gear, its upper end passing through the oscillating box in the tripod.

The Comet crusher is not only adjustable for the production of varying products but it will accommodate a large amount of wear when the same sized product is required. The mechanism for raising and lowering the spindle is so constructed that it is not necessary to stop the crusher to make the adjustment. By making the upper bearing a fixture, the position of bevel wheel hub also being a fixture, the distance between these two bearings remains the same, and the spindle sliding through them maintains its angle irrespective of the various positions in its height.

SOLID DIE THREADING MACHINE.

The illustration shows a solid die automatic threading machine manufactured by the Webster & Perks Tool Co., of Springfield, O. These machines are made in two styles and four sizes (a two-spindle rapid direct belted machine, and two, four and six-spindle geared machines). The cut is of the smallest or two-spindle size. There are independent heads and solid dies, insuring the manufacturer a large capacity of accurate work on every piece threaded. The solid die cheaply secures uniformity of every thread, a point that will be appreciated by those desiring interchangeabilty of parts. These machines will thread from ¼-inch to 1½-inch, inclusive. Changes from one size to another are so simple that they can be accomplished by a boy in the minimum of time. It is only necessary to stop that spindle on which a change is desired, while the remaining spindles continue in operation. These threaders are also adapted to special tapping, such as all kinds of castings, implement parts, etc. They have a positive and automatic reverse motion (always to within one-fourth of a revolution of the spindle), and are therefore very valuable where it is desired to tap holes only to a given depth.



SOLID DIE THREADING MACHINE.

The Webster & Perks Tool Co. also manufactures a two-spindle rapid or direct belted machine, designed exclusively for small threading up to and inclusive of ½-inch. It is employed by plow and stove manufacturers and others having large requirements of bolts up to the size mentioned. It has an output of 9,000 ½-inch bolts in ten hours.

Concerning the patent litigation entered into recently between the Chicago Pneumatic Tool Co., Joseph Boyer, the Standard Pneumatic Tool Co., and the Chouteau Mfg. Co., the two tool companies give notice that all suits have been dismissed by the advice of their respective attorneys, on the ground that the Boyer and Chouteau patents as they claim cover the fundamental principles of all pneumatic hammers. Recognizing the value of their respective claims, they have purchased licenses from each other covering their present style of hammers.

Fort Payne, Ala., is about to disappear entirely from the iron industry. The furnace is being dismantled and removed to Canada and the open-hearth steel plant purchased by the Republic Iron & Steel Co. will be removed to the Birmingham Rolling Mills.

E. H. Huenefeld, of Cincinnati, has purchased the stove foundry at Augusta, Ky., and will move his entire plant to that city.

Lockport, N. Y., citizens are taking a lively interest in a project for the building of blast furnaces and open-hearth and Bessemer steel works there. A committee is at work in the effort to secure the proposed $5,000,000 capital. The company will be known as the Lockport Iron & Steel Co. J. H. Hardebeck, of Illinois, is promoting the enterprise, and some preliminary drawings of the proposed plant have been made by Pittsburg parties. A land enterprise, with the sale of farm lands cut into lots, is part of the deal. It is announced that 3,000 men will be employed if the project is put through. C. G. Sutliff, Charles E. Dickinson and E. J. Taylor are members of the local committee. It is proposed to employ the simplex process of rolling structural steel, invented by E. M. Butz of Pittsburg.

The Wichita (Kan.) Pump Co. will erect a two-story plant, 190x300 feet.

REPUBLIC IRON AND STEEL CO.

After the quarterly meeting of the directors of the Republic Iron & Steel Co., held on Monday, Nov. 27, President R. S. Warner gave out the following statement, embodying the substance of his report:

"We have contracted for our raw material for our blast furnaces, such as coke, limestone, etc., to Jan. 1, 1901, our ore supply for our furnaces being covered from our own mines. We are also largely covered on raw material for our mills to July 1, 1900. Our monthly sales are keeping pace with our production, and the outlook is most encouraging. The physical condition of our mills has been greatly improved since they were turned over to us May 1, and extraordinary repairs have been made at quite a a number of our larger plants. All of these repairs have been charged up to operating expenses. As many of these repairs will last for some years we could properly have distributed these charges through a period of months. It is not, however ,the policy ot our company to do this. We consider it wiser to have all expenses for repairs absorbed from time to time, as they are made with the operating expenses, and we will get the full benefit in results later on.

"I am pleased to report satisfactory progress on the Bessemer steel plant at our Brown-Bonnel Works at Youngstown, O. Most of the foundations are completed and the balance well under way. We are installing in this plant a great deal of labor-saving machinery, and unless we have unusual delays we hope to be making steel there some time in March. We are adding an additional 25-ton open-hearth furnace to our open-hearth plant at Minneapolis. This will increase our output of open-hearth steel at this point very materially. We expect to have this ready for operation by February 1st. On our pioneer property at Thomas, Ala., we commenced mining coal from our Sayreton mine (which is the New Castle vein of coal) in September. We are also opening up the Pratt vein of coal and hope to be able to ship coal from this mine within 90 days. We are going to build two additional blast furnaces on this property. On account of inability to get blowing engines for anything like nearby delivery we can hardly expect to have the first furnace in operation before some time next fall. We are also opening up additional ore mines on this property. This property has been carefully examined by several of our executive committee and all of our reports from them are very enthusiastic. This property, when fully developed, will have great earning capacity, having abundant ore, coking coal and limestone to supply four furnaces for many years. Pig iron can be made there at very low cost, under any conditions, owing to the fact that labor is the only element that can increase the cost of production on account of the abundant supply of raw material.

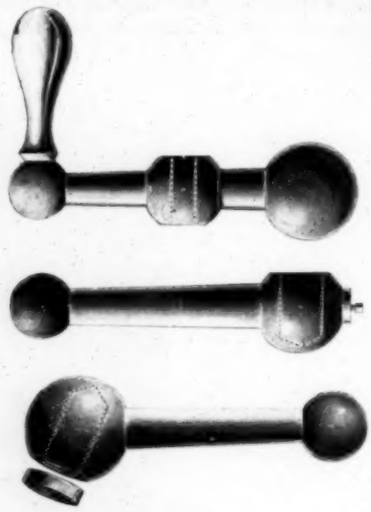
"Our production of finished iron and steel from May 1 to Oct. 31 inclusive, was 388,994 tons. Our production of muck bar from May 1 to Oct. 31, inclusive, was 218,411 tons. Our output of pig iron from May 1 to Oct. 31, inclusive, was 197,699 tons. Our average daily output of pig iron since Nov. 1st, has been 1,200 tons per day.

"The output of the six furnaces taken over by our company has been increased quite largely over what they were making prior to the time they were turned over to us, and are now making at the rate of over 400,000 tons per year. The earnings of the company so far already exceed considerably the requirements for preference dividend for the entire year and in view of the contracts made for future delivery and of the raw material secured to fill them, there can be no doubt that the earnings of the first year will leave a very large surplus over and above the amount of the annual preference dividend."

PETER L. KIMBERLY has begun suit at Pittsburg against Alexander M. Byers, of A. M. Byers & Co., and the Girard Iron Co. The petition says that on Aug. 8, 1897, the plaintiff was the owner of 2,876¼ shares of the stock of the Chapin Mining Co., of Michigan. The stock at the time was hypothecated to M. A. Hanna & Co. for amounts aggregating $25,000. Kimberly says he entered into an agreement with the defendant for half the sum sufficient to pay the indebtedness, and to turn the stock over to the defendant to be held by him as collateral security. The plaintiff said he received from the defendant the $25,000 and surrendered the stock, causing new certificates to be issued to the defendant, Kimberly alleges that between Aug. 10, 1897, and Aug. 1, 1899, the defendant received $31,638.75 in dividends, and that on Aug. 1, 1899, the stock was sold, with the consent of the defendant, and was transferred to the purchaser at the rate of $118 75 a share, the whole aggregating $343,554.69. The amount sued for is the difference between the amount due the defendant and the proceeds of the sale.

STEEL BALL MACHINE CRANK HANDLE.

The Norwood Bicycle Co., 62 Plum st., Cincinnati, is making a specialty of steel ball machine crank handles. These are turned from solid steel and are light and susceptible of a high degree of finish. They are manufactured with key ways or ready for tapping, and in any special sizes or shapes. The stock handles produced include the three styles shown in the engravings, the first being the regular handle with center



STEEL BALL MACHINE CRANK HANDLE.

ball, and large or small end ball; the second is an ordinary two-ball lever handle ready for tapping and fitted with a set collar; the third is a handle adopted for tail stock center tightener on lathes. The Norwood Bicycle Co.'s plant, recently burned, is expected to be running in full within a short time. Many orders for crank handles have come recently from machine tool manufacturers.

November Record of New Cars and Locomotives.

The November orders for railroad equipment, as noted by the *Railroad Gazette* showed a total of 11,281 cars and 396 locomotives. "Of the cars, 4,507 were box, stock and furniture cars; 3,845 were gondola, coal and ore cars; 1,863 were steel cars; 580 were flat cars, and 486 were for passenger and street railroad service. About 1,300 of the cars are to be built by the railroads at their own shops. Of the 396 locomotives 22 were for export, and the division of types was approximately 73 passenger, 268 freight, and 55 switching locomotives. The orders for locomotives were about 20 per cent more than in October, while that month showed a number of orders far in excess of any previous month of this year. The car orders in November were only about one-third those placed in October and less than those placed in August, but were greater than those placed in the other summer months or in September. It is understood that both locomotive and car builders are well filled with orders far into the new year, and while no exceptionally large car orders for the immediate future are now in sight, the aggregate of orders actually under consideration is more than equal to those placed during November."

The Georgia & Alabama Mining Co. has recently been incorporated with a capital of $300,000, to mine coal and iron ore, and to manufacture coke and pig iron. The company will develop the mineral land in the vicinity of Birmingham, Ala.

75 YEARS OF IRON MANUFACTURE.*—I.

BY JOHN FRITZ.

It was my intention to have given a brief account of the early experiments with the Bessemer process at Cambria and Wyandotte, and also a brief notice of the earlier works that went into the business; I soon found, however, that it was not possible to do so in a paper such as I was called on to read, and, besides, Mr. Wm. F. Durfee and Mr. R. W. Hunt, who, each by turns had charge of the experiments at Wyandotte, have already put the general results on record. Consequently, I will confine myself to such a paper as I was called to give—some personal reminiscences of my connection with the manufacture of iron and steel, which is unfortunate for me, as I would much prefer to tell what others have done than what I have done myself. But, as I was asked to do this by the officers of your society, and did not seek the honor, I beg you will, as far as possible, excuse what will doubtless seem somewhat egotistical, and ask you to bear in mind that what I have to say is only a general history of the early developments of the iron and steel industry in this country, which others also had much to do with.

This being the last year but one of the century that has done so much to change the face of society, and for the betterment of mankind, it will be interesting to take a brief retrospective view of the events that have taken place during this remarkable period, and in doing so we witness the most wonderful progress that has been made in the advancement of the arts of science and civilization, all the effects of which are far-reaching. In the very front we see the phenomenal progress that has been wrought in all the various branches of manufacture in all parts of the civilized world. We look again and find that the manufacture of iron is in the lead, and that the United States comes in for a large share of this all-important branch of manufacturing industry, which is the advance guard of civilization, one which has done so much to build up this country and served her so well both in peace and in war.

First Puddling Furnace and Plate Mill.

While I have not been asked to say anything about matters beyond the date of my own experience or the life of the institute, it seems necessary, however, that a brief allusion should be made to the first puddling furnace and plate mill that were erected, in order that the great advance that has been made in this branch of the manufacture may be more fully appreciated.

The first puddling furnace in this country was built at Plumsock, on Redstone Creek, about midway between Connellsville and Brownsville, in Fayette County, Pa., in 1817. A flood caused the partial destruction of this mill. The machinery was subsequently removed to Brownsville. In 1819 a rolling mill was built at Pittsburg in which there were four puddling furnaces. This mill was accidentally blown up, and permanently dismantled in 1829, and the machinery was taken to Covington, Ky. Both enterprises thus seem to have ended in disastrous failures.

About 1810 Isaac Pennock built a rolling mill (at that time called a "slitting mill") near Coatesville, in Chester County, Pa. In 1816 it came into the hands of Dr. Charles Lukens, a son-in-law of Isaac Pennock, and was operated by him until his death in 1825. It was during this period and on this mill that the first boiler plate was rolled in this country. The blooms were heated on a grate fire and the rolls were driven by an old-time undershot water wheel. When a boy I heard the older men say that the mill was often short of power, and frequently all the workmen would run and get on the buckets and tread with them, in order to prevent a stall which would have caused fire cracks in the rolls, and sooner or later a broken roll. This being before the days of railroads, coal was hauled from Columbia, 35 miles distant, and the plates were teamed to Philadelphia 35 miles away, and were shipped without being sheared. A notable circumstance about these works is the fact that they have always remained in the family of Isaac Pennock, and are now operated by his descendants of the fourth generation. What I have now said will be sufficient to give you some idea of the conditions of the trade at that time, and will enable you better to appreciate the great improvements that afterwards were made; and also brings us practically down to the birth of the institute in 1824.

From 1824 until 1836 but little progress was made in the way of marked improvements. During the thirties there were some puddling furnaces built, to puddle run-out or refined pig metal, and eventually they got in the way of using some close grain pig iron in connection with the refined metal. In the early forties puddling began to come into general use, but only close iron was used. In the years 1844-45 the manufacture of rails commenced. This at once gave it the leading position in the manufacture of iron, which it held until it was beaten by the Bessemer process, to which I shall refer again. About this time the manufacturers' trouble begins. The demand for puddlers soon exceeded the supply, and they thought they ought to have things their own way. Up to this time the old-fashioned Welsh hammer was the only mode in use in putting the puddled ball in shape for the rolls. The hammer man, or "shingler" as he was called, at that time, was the king bee, and when he went wrong, as he frequently did, the puddlers had to quit work until such a time as Mr. "Shingler" was ready to go to work, which sometimes required several days; and when at work woe be unto the puddler who might happen to be on bad terms with him.

The hammer striking a uniform blow no coaxing could be done; consequently great skill was required during the first few strokes of the hammer to keep the ball in such shape that it could be edged and up-ended in order to get a good-shaped and compact bloom. Should the "shingler" fail in this, which he could and at times did, and that without any apparent intention, then a row was started which sometimes ended in a fisticuff, as we had bullies in those days as well as now, but not so well trained, and the rules of the ring were not such as they are today; if they had been, they would not have been strictly adhered to.

The next improvement in this line was the introduction of what was known as the "crocodile" squeezer, which was entirely unlike the hammer in every way, and it was so easily worked that almost any of the puddlers could put their own work in shape; but, unfortunately for the manufacturer, they could coax a ball into shape that was not properly worked in the furnace. So, while this was entirely satisfactory to the puddler, it was very unsatisfactory and unprofitable to the manufacturer, with the result that there was constant bickering between the employers and the employes, a condition of affairs that should not exist.

Next came the "Burden" and "Winslow" squeezers; the latter was used for a time, but finally the "Burden" came into general use, and is to this day as nearly perfect a machine for the purpose that has ever been devised. Not alone on account of its simplicity in construction and the perfect manner in which it does its work, but because, also, it establishes justice between the ironmaster and the workmen from which there is no attempt to make an appeal. When a ball would break, the workman, without saying a word, gathered together the pieces and took them back to the furnace and worked them into a proper condition, and in the end the squeezer proved to be the puddler's friend. Notwithstanding all its good qualities, its introduction caused strife in practically all the mills that introduced it down to about the year 1856. Some of the strikes were long and bitter, and many incidents might be recited in relation to its introduction, some amusing, some ridiculous, and others revengeful. However, soon after the system came into general use, an armistice was agreed upon, which finally resulted in a treaty of peace, which was advantageous to both parties.

In or about the year 1848, boiling came into general use, which was a great improvement, and puddling soon became the all-important branch of the great iron industry of the country, and continued in the lead until it was overtaken by the almost magical invention of Sir Henry Bessemer, to which I shall refer later.

Early Blast Furnaces.

Until 1840 all the pig iron produced in the United States was made with charcoal. My first connection with a furnace dates from 1839. It was driven by water, a wooden blowing

*An address delivered in Convention Hall, National Export Exposition, Philadelphia, Wednesday, Oct. 4th, at the celebration of the seventy-fifth anniversary of the Franklin Institute.

cylind r connected with the crank by a wooden beam. The crank, the journal and the wings that were fitted in the end of the water-wheel shaft to carry the wheel and to drive the blowing cylinders. Neither of the journals were turned off, but were put to work just as they came out of the sand. It was blown by an open tuyere. The whole plant was of the crudest construction. The weekly make was about 16 to 20 tons. It was placed against a bank, level with the tunnel head so as to avoid hoisting the material up. This was about the character of the furnaces in general use at that time.

I was sent there as a "cub" to put up a belly-pipe which was made at the shop in which I was learning my trade. When it was put in place it was, as I remember, about six or eight inches too short, and I supposed somebody had made a mistake in the length. The founder was a consequential-looking man, and quite stout, with a blue flannel shirt and his "pants" held up by a rather broad leather band buckled around his body, somewhat in the order of many we see to-day, but was not gotten up in the same style. He said rather brusquely that "it was all right." The pipe was connected at the rear end to the main pipe by a short leather connection, which I was told was to allow the belly-pipe to swing out of the way so that they could get the cinder out.

This was the general condition of the furaces until 1840, when Mr. David Thomas, since affectionately called "Father Thomas," made the first anthracite iron in a commercial way that was made in this country. This was the commencement of the phenomenal development of the blast furnace practice that has taken place in the latter part of this century.

We left the rolling mills in 1824 in a very crude condition, and there was no marked improvement in them until the manufacture of rails commenced, which, as already mentioned, was about 1844. But even at this time the plans of the mill and manner of building practically remained the same, being geared, and it seemed to me that the general impression amongst the rolling mill proprietors was that the more wheels they could get in the better was the mill. Down to this time the carpenter or millwright had largely the say, consequently wood was much used. The shafts were generally made square, and the fly-wheel and gear-wheels were secured on them by the use of wooden wedges, into which other thin wedges of iron were driven. No matter if the foundation was built of wood or stone, a large piece of timber was placed on top, to which the housings were secured; the idea being that it was essential that the train should have some elasticity in order to take the shock off the machinery, thereby preventing breakage.

After the manufacture of rails commenced in 1844, more rigid and better workmanship was required. The mills, as heretofore, were all geared, but the carpenter and millwright were superseded by the machinist. The shafts were now turned up, wheels were bored out, and the mill all fitted up in a more workmanlike manner.

From 1845 to 1856 there were but few improvements made, either in machinery or the manner of rolling, except the introduction of the rail-straigtening machine which took the place of the 60-pound sledge and a special man to handle it. When he wanted to rest the works had to come to a standstill until such a time as he was completely rested, sobered up, or restored to health, as the case might be.

The Mechanical Engineer as a Factor.

The year 1857 is a memorable period in the history of the manufacture of iron. As before stated, in 1844 the forge carpenter and millwright were superseded by the machinist, who now comes to the front as a mechanical engineer, not full fledged, but with an amount of knowledge gained by experience which qualified him for the important duty which awaits him. Down to 1857 all the rails were rolled on a two-high train, the pile being passed back over the top roll, which meant a great waste of time and loss of heat. When the flanges once began to crack, which was one of the serious troules, being all the time rolled in one direction, it greatly aggravated the difficulty. The result was that when an imperfection occurred in the flange, the trouble increased with each pass through the rolls, and so extended that it was a common occurrence for the flange to tear off the whole length of the rail and wind around the roll, forming what, in rolling mill parlance, was called a collar, which very generally ended in breaking some part of the train and often the roll.

The iron was frequently both red and cold short and all other shorts, and in addition to this would stand but little heat, consequently the end of the pile which entered the roll first would split and open out like the mouth of an alligator. Then, of course, it would not enter the rolls without force, which was applied with the buggy, using it as a battering ram. After making several vain attempts to get it to enter the rolls it very frequently had to be turned end for end. The loss of time taken up in going through all this was such that it was almost an impossibility to get a perfect rail. Had it not been for the use of putty, oxide of iron and the absence of inspectors there would have been but few rails shipped. In order to get over the difficulty of the flanges tearing off we went to quite an expense. Some iron of a better quality was used for the flanges, which, in a measure, gave some relief in that direction. But the iron being much stronger, required more heat and greatly increased the difficulty of opening the end of the pile in the first few passes. We were now in a sad dilemma, and something had to be done. I was sick at heart, and had it been manly I would have run away.

The Three-High Mill Broached.

But, during all this time, I was giving the subject much consideration, and had fully made up my mind that if a three-high mill could be made to work, the difficulties could all be overcome; besides, I had made up my mind that it was the only proper way to roll iron. The suggestion was met with a rebuff, which was not unexpected. They said in subtsance: "It was a visionary scheme; it had never been done, and had it been practical it would have been done long ago." In reply, I told them something must be done or there would be a large funeral, and I did not want to be one of the mourners. The subject was then more seriously taken up by the company, and it was suggested that a better ore should be secu ed as a mixture to improve the quality of the iron; but the location of the works was such that a suitable ore could not be got at a price that would permit it to be used as a rail mixture, so this course was abandoned

The company now began to see that it was necessary that something should be done. The directors called a meeting, and, after consultation with some practical iron men, decided to put up a geared two-high mill, and by greatly increasing the speed of the rolls, the rail would be finished in much less time, and consequently at a higher heat, which would prevent the serious trouble of rough and torn flanges. After some pertinent discussion, I was ordered to build a new mill, two-high geared. As my patience had become exhausted, and being thoroughly disgusted and especially so with the geared mill, I most emphatically said I would not do it, as two of the most objectionable features of the present system would still be retained. I was then asked what right I had to dictate to the company in regard to the policy they should pursue in the line of their business. I answered that I had no right, whatever, but that I was thoroughly convinced that it woul not remove the difficulty and in the end would be a failure and the result financial disaster. Being a young man and the only capital I had in the world being my reputation, and that being quite limited, I did not purpose placing it in danger where the chances were so unequal. This interview ended in a suspension of hostilities, and for a short time nothing was said on either side. But the trouble in the mill still continued, and something must be done and quickly. Having already lost my reputation for complaisance and being considered as the most arbitrary of men they had ever met, I consequently concluded that I would do as I had been compelled to do before and many times since—assume authority and go ahead, which I did; and commenced work on the patterns. The drawings had already been practically completed.

After the pattern for the housing was well advanced, Mr. E. Y. Townsend, the vice-president, came out to the works and I informed him of what I was doing, and again talked the situation over with him. He said nothing, but thought it proper to let the company know what was being done, to which I assented. In about a week, as I remember, he came to the works again. This time he was armed with a legal document, opposing the spending of the money in the way it

was being done. He handed me the document to read, which I did. I then handed it back to him and said nothing. He then asked me what I thought about it and the best couse to pursue. In answer, I said: "You know the troubles we have had, and it is useless to go over them again, and you know my opinion, which is irrevocable." After some friendly talk on the condition and the importance of the change proposed, he said: "Go ahead and build the mill as you want it." I asked: "Do you say that officially?" to which he replied: "I will make it official." And he did so.

When I look back to that eventful interview, which took place on a Sunday morning long years ago, and recall to mind Mr. Townsend and myself, with evidences of failure on all sides, and surrounded by the gloom of future uncertainties, I cannot but feel that it was the most critical period not only in my own career, but also in that of the Cambria Iron Co. And here I wish to say that to Mr. E. Y. Townsend belongs the credit not only of the introduction of the three-high rolls, but also for a large share of the subsequent marvellous prosperity of the Cambria Iron Co., which followed the introduction of the three-high mill and its many accompanying improvements.

Review of the Technical Press.

BY DR. RICHARD MOLDENKE.

Expansion of Iron and Steel at High Temperatures. [*Stahl und Eisen*, Oct. 15th.]—Prof. Le Chatelier publishes some observations on steel and iron under high degrees of heat. The method of Copeau was used to determine the expansion produced. It consist of a mirror of melted silica which inclines more or less according to the difference between the expansion to the test piece, and a support to the Sévres porcelain. A ray of light is reflected and furnishes the means of obtaining the reading. Three periods are distinguishable in heating a piece of iron or steel; the first embraces the lower range up to the beginning of molecular changes, the last commences where these changes are complete, and the second takes place in the changes of condition themselves. During the first period (up to 1,375 degrees F.) the co-efficient of expansion is pretty constant, averaging .000014; at 1,400 degrees F. it is 000017. The second period shows a great variation in results, depending upon the carbon contents to a great extent. This is really to be expected, for below 1,375 degrees F. at least four-fifths of the mass remains chemically uncombined iron in which crystals of carbide of iron are scattered about. Above the critical points, however, the iron and carbide unite to a congealed solution, in which state its expansion is in no way related to the expansion of the separate parts and may be much larger. Prof. Le Chatelier has not succeeded in making the molecular changes strictly reversible, and consequently gives the following results only tentatively:

Per cent carbon, . . .	0.05	0.20	0.50	0 80	1 21
Critical point, ...	1550° F.	1415°	1345°	1345°	1335°
Per cent contraction, .	.26	.23	.21	.08	.10

There is much variation in the contractions, many of them being accompanied by expansions which modify results considerably. Very likely this is due to two separate effects coming nearly together and overlapping. Thus the molecular change in the iron which means a contraction of .26 per cent, may be accompanied by a solution of carbide which at .9 per cent carbon gives an expansion of .26 per cent—or exactly neutalizes the effect.

Fraser & Chalmers of Chicago, have sold one of their adjustable Comet G crushers to the Momence Stone Co., Momence, Ill., (owned by the Chicago & Eastern Illionois Railroad), after a severe competition with other gyratory crusher manufacturers. This crusher is the largest size built and has the unusual capacity of 200 tons per hour crushed to 2½ inch ring One reason for the selection of the Comet machine was the adjustable feature which saves the putting in of another crusher to regrind tailings and spalls Any other make of gyratory crusher owing to lack of adjustment would have necessitated a smaller machine for grinding tailings.

The Cherry Valley Iron Works, at Leetonia, O., have filed a suit against the Leetonia Forging Co. to collect $28,835.32 alleged to be due for labor, material and money.

AGAINST THE CAST IRON PIPE COMBINE.

In the United States Supreme Court Monday, Dec. 4, the Addyston pipe case was decided. This case involved the constitutionality of the combination of pipe manufacturers to manufacture pipe which, it was charged, was a trust. The decision was handed down by Justice Peckham and was adverse to the combination. The opinion of the Court of Appeals for the Sixth Circuit was affirmed.

In reviewing the case Justice Peckham said that it had been brought under the anti-trust act of 1890, and that an injunction was asked to enjoin the six corporations engaged in the manufacture of water and gas pipe, which composed the combination, from continuing to do business under the agreement by which they had divided the territory of the United States among themselves, and by which they had arranged to fix prices. Under this agreement the members of the combination provided for auctioning off the right to make bids for supplying with pipe cities not in allotted territory, the successful bidder to meet no opposition from other members of the trust, or if other bids were made, none of them should be higher than that of the company to which the award had been made by the combination. In cases in which bids were asked in territory allotted to members of the combination the agreement was that no bids should be made except under the supervision of the company in charge of that territory under the agreement.

The charge was that such a combination was a violation of the clause of the Constitution regulating inter State commerce. The district court, in which the case was first heard, refused to take this view of it, but it was reversed by the Court of Appeals of the Sixth Circuit, which held the combination to be antagonistic to the Constitution, ordering the issuance of the injunction prayed for. This latter decision was affirmed by the Supreme Court, on Monday, with a modification that the injunction should be construed as applying to inter State business only.

Two Questions Involved.

There were two questions before the court in connection with the case. The first was whether the constitutional clause for the regulation of inter State commerce applied to individuals and corporations, and the second whether, if the clause should be found to so apply, the combination is a regulation of inter-State commerce. The court held that the constitutional clause did apply to individuals and corporations and that the agreement does by its provisions restrict and restrain commerce between the States. Hence the agreement was decided to be void as applying to inter State business, and the injunction sustained.

The six companies composing the combination affected were the Addyston Pipe & Steel Co., of Cincinnati; Dennis, Long & Co. of Louisville; the Howard Harrison Iron Co., of Bessemer, Ala.; The Anniston Pipe & Foundry Co., of Anniston, Ala.; The South Pittsburg Pipe Works, of South Pittsburg, Tenn.; and the Chattanooga Foundry and Pipe Works, of Chattanooga, Tenn. Their agreement provided that there should be no competition between the companies in thirty six States in the manufacture and sale of cast iron pipe. The case was first brought and tried in the Circuit Court for the Eastern District of Tennessee.

Passing upon the objection that the constitutional provision could not be held applicable to individuals Justice Peckham said: "We conclude that the plain language of the grant to Congress of power to regulate commerce among the several States includes power to legislate upon the subject of these contracts in respect to inter-State or foreign commerce which directly offset and regulate that commerce, and we can find no reasonable ground for asserting that the constitutional provision as to the liberty of the individual limits the extent of that power as claimed by the appellants. We, therefore, think the appellants have failed in their contention upon this branch of the subject."

Destruction of Competition the Test.

Remarking upon the general aspect of the case, Justice Peckham said: "We have no doubt that where the direct and immediate effect of a contract or combination among particular dealers in commodity is to destroy competition between them and others, that the parties to the contract or

combination may obtain increased prices for themselves, such contract or combination amounts to a restraint of trade in the commodity, even though contracts to buy such commodity at the enhanced price are continually being made. Total suppresison of the trade in the commodity is not necessary in order to render the combination one in restraint of trade. It is the effect of the combination in limiting and restricting the right of each of the members to transact business in the ordinary way, as well as its effect upon the volume or extent of the dealing in the commodity that is regarded."

The opinion then adds: "It is almost needless to add that we do not hold every private enterprise which may be carried on chiefly or in part by means of inter-State shipments is, therefore, to be regarded as related to inter-State commerce so as to come within the regulating power of Congress. Such enterprises may be of the same nature as the manufacturing of refined sugar; that is, the parties may be engaged as manufacturers, of a commodity which they thereafter intend at some time to sell and possibly to sell in another state but such sale we have already held is an incident to and not the direct result of the manufacture and so is not a regulation of or an illegal interference with inter-State commerce. The principle is not affected by anything herein decided."

The decision draws a clear distinction between combinations affecting inter-State commerce and those applying to one State only. The opinion attracted very general attention because it is the first opinion on the subject of trusts which has been handed down since the subject of trusts has come into great prominence.

PATENT PROTECTION IN PRACTICE.

TO THE EDITOR:

During the last six months orders for pyrometers, revolution indicators, and repair work have come in so rapidly that I could not fill them to the satisfaction of my customers. This certainly is a novel experience to me; and it has given a much keener relish for the turkey today, than did the retrospect, to me and many others, in November, 1893. Perhaps it was a crow we had that year. There appears a little lull just now, as though the extraordinary impulse to the iron trade had reached its climax.

I could put out two or three improvements to pyrometers; but the questions come up, What good? Will it pay? The public certainly would reap the benefit but what would I reap? A noted inventor has said: "I must patent an improvement or someone else will do it after it is out, and sue me; and if I do patent it I must sue the infringer." You see the dilemma.

After one has spent six months perfecting the details of a machine and paid the cost of a patent—the two combined rarely under $500—he will see it copied as soon as letters patent are out, and the public and some sharper reaping the benefit of such unintentional philanthropy.

A novice will say: "Sue him; put an injunction on him." Gently, my dear sir. Did you ever enter the tedious mazes of a patent or any other lawsuit; have your mind distracted day and night from its usual business channel, only to find, after years of delay, annoyance and discourtesy, a verdict in your favor, and a defendant with nothing left to take hold of, and probably something new on the market to take its place? This is not the worst of it. You will sit down and ponder over the vast amount of perjury you have been the cause of, either by your own witnesses or your opponents'.

Shall I voluntarily rush into such a hazardous enterprise? The government has done all it can to protect inventions, with due justice to the public. It is not in my power to suggest a remedy. I am writing nothing new. Only putting facts well known to many, in a new dress; also giving a caution to would be patentees, that they do not become elated because they have received a patent on some improvement which they are positively sure will be of great public and pecuniary value. They may have some day to console themselves philosophically, that they have not lived in vain, and that patent or no patent, the invention has proved of great public value.

EDWARD BROWN.

Philadelphia, Pa., Nov. 30, 1899.

Pittsburg Molders' Strike Settled.

The difficulty between the Pittsburg machinery molders and their employers has been finally settled, for the time at least. Last week the men went out on strike for the second time and this week practically all have been taken back to work. The minimum wage rate of $3 a day has been granted, with a 10 per cent advance to those formerly making $2.75 a day or more. About 70 per cent of the men were making $2.75, about 15 per cent less than this and about 15 per cent more than $2.75. None of the foundrymen have signed any agreement in relation to the matter, and a number of points for which the men contended, some of which the employers had agreed to grant, if the matter had been left to a settlement by arbitration, were entirely lost by the men. No yearly contracts have been signed, and the employers are free to discharge men whom they consider not worth the minimum. The men's representatives have made a great many claims during the pendency of this difficulty and at its conclusion, which were published in the daily press, but which were without foundation.

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify THE *Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market, and Some of Their Wants:—

L. K. Hirsch, 549 The Rookery, Chicago, is in the market for a shear for cutting old boiler plates, and two or three shears for cutting pipe and tank plates for scrap. The tools may be either new or second hand, but must be in good condition.

The Emlyn Iron Works has been incorporated at Chicago, with capital stock of $145,000, to manufacture iron and steel and their products. The incorporators are Nicholas W. Hacker, William B. Ward and Myles J. O'Kell.

The New Jersey Zinc Co., 71 Broadway, N. Y., will buy a blowing engine in good condition, capable of delivering 10,000 cubic feet per minute; pressure 10 pounds with 70 pounds steam.

The Backstay Machine Co., of Union City, Ind., was incorporated last week. Capital, $20,000.

The Capital City Foundry, of Indianapolis, Ind., has been granted a charter. The capital stock is $2,000.

Fires and Accidents:—

Fire in the bending shed of the Charlestown (Mass.) Navy Yard, Nov. 25, damaged machinery to the estimated amount of $100,000.

Schuch & Martin's large foundry, Covington, Ky., was destroyed by fire, Dec. 2. Loss, $50,000.

Mahle & Sons' machine shop at Corry, Pa., burned, Nov. 29 with $4,000 loss.

The explosion of a boiler in the billet mill of the Illinois Steel Co.'s Joliet plant seriously injured nine men, and caused considerable damage to the plant.

New Construction:—

The Standard Stove Works, of De Kalb, Ala., will erect a large addition to its plant.

It is announced that the E. P. Allis Co., of Milwaukee, has decided to build an addition to its plants next spring. Cost, about $400,000.

Work has been commenced on the new Grand Island foundry, at Grand Island, Neb., which is to replace the Lykke foundry, burned some time ago.

The Berry Flush Tank Co., of Iowa City, Ia., contemplate the erection of a foundry building. The equipment will include gas engines, blowers, furnaces, ovens and foundry supplies.

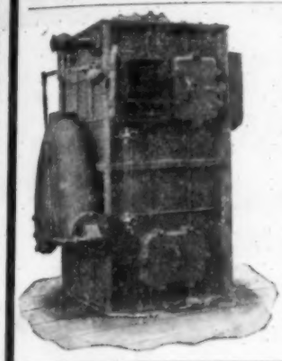
Permits have been taken for the following additions to manufactories in Detroit: One-story frame addition to the Fuller Motor Co.'s works; one-story addition to G. W. Cope's foundry.

The Weber Gas & Gasoline Engine Co., Kansas City, Mo., will erect a plant at Sheffield, Mo., and will manufacture auto mobiles.

The Nickel Wheel Scraper Co., of Independence, Mo., have purchased a site in Kansas City for the erection of a factory.

The Detroit Copper & Brass Rollig Mills will erect a plant 50x106 feet, and two stories high. Costing, $8,000.

The Diamond Stamped Ware Co., of Detroit, is about to



When it Comes Down to Making Use of the Heat in Steam

The finest steam engine ever built is not "in it" with a COCHRANE HEATER, for even with the best condensing engine over 80% of all the heat that was in the steam when it left the boilers is washed away into the sewer, or to waste, through the condensing water. A non condensing engine generally utilizes less than 10% of the heat in doing its work; the balance (say 90%) goes straight to the atmosphere, unless use is made of it for heating purposes.

All of the heat in the steam entering a Cochrane Heater is made to do work; that is, it is compelled to heat water and to purify it; excepting the slight loss by radiation, none of this gets away, unless more is present than is required to heat the supply to the temperature of the steam.

There are no other heaters quite so reliable—so free from repair, and so easy to clean as these "COCHRANES."

HARRISON SAFETY BOILER WORKS,

Clearfield & 17th Sts. PHILADELPHIA, PA.

erect a factory valued at $30,000 The building will be 80x200, and three stories.

The Globe Range Works, Kokomo, Ind., may be enlarged in the near future as a new company is being organized to take the plant and manufacture ranges on a more extensive scale.

The United Boiler Co., Girard, O., which lately completed the erection of a new plant, has put a force of men to work on a number of contracts for boiler and blast furnace work.

The foundry and machine shop of Snyder, Zimmerman & Co., at Millersburg, Pa., is nearing completion.

The Louisville Bolt & Iron Co., Louisville, Ky., recently incorporated, is looking for a site for the erection of a plant.

The Truxal-Painter Machine Co., of Chattanooga, Tenn., has purchased the shop and machinery of G. W. Derrickson.

A charter has been issued to T. Rowland's Sons for the manufacture of iron and steel at Cheltenham, Pa.

The Pittsburg District:—

It is reported the Carbon Steel Co. will spend about $150,000 in improvements to increase the output.

The Pittsburg Locomotive Works, at Allegheny, Pa., are full of orders and running their plant to full capacity. Among recent orders are ten engines for the C. L. & W. R. R.; eight for the Duluth, Missabi & Northern R. R., and two for the Monongahela River R. R.

The machine shop of the Hydraulic Machine Co., 54th st. and Allegheny Valley Railroad, Pittsburg, which burned last week, will be rebuilt at once. Henry Aiken is proprietor.

At a meeting of the directors of the Aschmann Steel Casting Co., Sharon, Pa., it was decided to expend a large sum in improvements, double the capacity and employ twice the number of hands. The plant now furnishes work to 200 men.

W. B. Scaife & Sons, of Pittsburg, have the contract for enlarging the mills of the W. Dewees Wood Co., of McKeesport. The mills will be enlarged to about double their present size and new machinery introduced. The Wood Co. makes a specialty of Russia iron and locomotive boiler jacket iron. It is the largest concern of its kind in the world. It employs about 1,500 men. The new improvements will furnish employment for several hundred more men.

The charter has been issued for the Hussey Truxall Steel Co., Pittsburg. The incorporators are Ephraim Truxall, C. G. Hussey, J. S. Speer, J. D. Scott, O. P. Curran, Jr., H. E. Barlow, and J. P. McCord. The charter was granted with a nominal capitalization, which will probably be increased shortly to $100,000. The plant built some years ago at New Kensington, Pa., by Nimick, Jack & Tyson, and since operated by other parties, for making hot and cold rolled band and strip steel and tack plate, will be converted into a plant for the manufacture of various sections from old steel rails, for agricultural implement manufacturers and others. Mr. Truxall controls a process for improving the texture of the steel in old rails for rolling into such sections.

The Pittsburg Coal Mine Supply Co. will shortly apply for a charter. It is intended to erect a plant to manufacture mine cars, tipple equipment and mine appliances generally.

The Steel Car Forge Co., Pittsburg, has received its charter. The capital stock is $200,000, and the company will erect a plant for the manufacture of drop forgings for railroad cars. John W. Chalfant, J. H. Fraser and other Pittsburgers are interested.

It is stated that F. J. Torrance, of the Standard Mfg. Co., Pittsburg, is at the head of another project to consolidate the manufacturers of bath tubs and other enameled ware.

The firm of Thomas Carlin's Sons, Allegheny, Pa., has prepared plans for the erection of an addition to its plant on River ave., Allegheny, 125x100 feet.

The Crescent Steel Co., Pittsburg, has received highest honors for its exhibit of tool steel, dies, springs, etc., at the National Export Exposition, including a silver medal and diploma. The exhibit is to be sent to the Paris Exposition.

The Atlantic Iron & Steel Co., Harrisburg, Pa., which was formed to take over some Central Pennsylvania plants making skelp, is negotiating for the purpose of a strip of land on which to erect a plant for the manufacture of merchant pipe.

The Harrisburg (Pa.) Pipe Bending Co. has purchased additional land on which to make an extension.

Chicago District and Northwest:—

The Western Foundry Co.'s new foundry 50x211 feet at 2281-3 Thirty-Sixth place, Chicago, is to cost $10,000.

Arrangements have been made to increase greatly the stove works plant at West Superior, Wis. A malleable iron plant is to be put in and will be ready for operation early in the spring.

The Berlin Machine Works, Beloit, Wis., are building an extension to their main building which will be 300 feet long. A 600 h. p. cross compound condensing Corliss engine is being added.

The malleable iron plant of Forster, Waterbury & Co., Chicago, began operations last week. Its output will be about 20 tons per day.

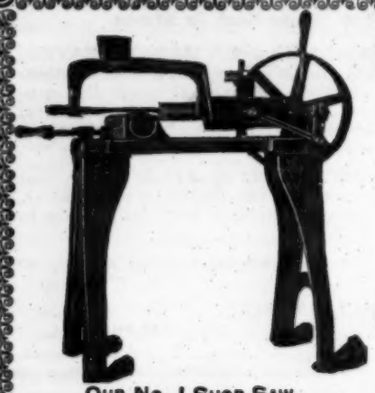
A. J. O'Leary has purchased the Phoenix Chain Works which adjoins his plant on W. Lake st., Chicago, and will manufacture heavy chains. All departments have been strengthened in equipment.

The Falk Co., of Milwaukee, Wis., originator of the cast welding rail joint and builder of electric railways, switches, frogs, etc., is building a steel foundry, machine shops, and making other additions. The expenditure will be over $100,000.

G. A. Crosby & Co., whose plant is now located on Clinton st., have begun the construction of a new plant in the section of the South Division known as Bridgeport. Three buildings will be erected at present. The machine shop will be located at 2836 to 2844 Archer ave., two stories and 96x192 feet. It will be equipped with crane and other modern machinery. A blacksmith shop, 35x96 feet, will be built at 710 Farrell st., and a boiler and engine house, 30x50 feet, will be erected near by. The cost of the buildings, exclusive of machinery, is estimated at $40,000.

General Industrial Notes:—

An agreement has been reached between the molders and the Central Foundry Co., of Medina, N. Y. The molders have returned to work, having received a promise from the company that the rate of wage will be adjusted. Concessions



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It you need a cheap saw of small capacity write us.

THE Q AND C

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New York.

were made on both sides. There is no formal recognition of the union, but grievances will be heard by the superintendent when presented through a shop committee.

The Baldwin Locomotive Works have just turned out for the Cambria Steel Co. some very heavy shifting engines of the six-wheel type. They have 21x26 inch cylinders, a total of 1,908 square feet of heating surface and weigh in working order 218,000 pounds, making them the heaviest and most powerful yard engines in the world.

The famous Warwick farm located in Chester County, Pa., has been sold. The old Warwick furnace which is located on this property was put in blast in 1730 and many of the cannon used in the Revolution were cast there.

Macungie Furnace at Macungie, Pa., started up this week.

Scranton, Pa., business men are opening subscription books for a tin plate works, of which J. K. Torbet, of Chicago, is promoter.

In addition to the boilers removed from Alexandria, Ind., for the Republic Iron & Steel Co.'s Bessemer plant at Youngstown, O., new boilers have been received from the Stirling Co. and are being put in place.

The bondholders of the Troy (N. Y.) Steel Co. met in New York recently and appointed a committee to investigate the cost of necessary improvements and other questions connected with the proposed starting up of the plant.

At Springfield, Ill., the United States Court authorized the receiver to operate the Continental Wire Co.'s plant at Granite City, under the direction of the Merchants' Wire & Nail Co., the latter company to put the plant in proper condition, pay all expenses of operation, and pay the receiver $24,000 per annum in consideration of the agreement. The order has the effect of a lease of the plant by the Merchants' Wire & Nail Co. The American Steel & Wire Co. holds the $150,000 bonds of the Continental Wire Co.

The stockholders of the Springfield (Ill.) Boiler Works decided to increase their capital stock from $78,000 to $150,000.

Hartford, Conn., union molders have declared the Pratt & Whitney foundry a closed shop, a demand having been made that it be unionized.

Frank B. Baird and others have formed the Ishpeming Co., of Buffalo, N. Y., capital $160,000, to mine iron ore. A property on the Marquette range will be operated to supply ore for consumption at Buffalo.

At Harrisburg, Pa., ex-Congressman Rife and brothers, of Middletown, Pa., got a verdict for $4 677 against the American Tube & Iron Works for damage by gases, smoke, and vapors to property adjoining the defendant company's plant.

The Cleveland Ball & Screw Co. has increased its capital stock from $10,000 to $80,000.

AIR AND ELECTRIC POWER IN SHOPS.

The number of concerns now making air compressors and compressed air appliances, and the extent of some of the shops engaged upon this work are much greater than would ordinarily be imagined. At the same time the orders for these products come largely from mines and quarries and from industrial plants doing structural and boiler work, where there is a demand for punching and riveting machinery. Machine shop managers as a whole probably do not

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WATTS. We print the name large for we want every consumer of foundry iron to see it. **WATTS.**

Those who have tried Watts know its merits. It is strong, soft and tough. Can be melted alone, mixed with other brands, or used as a scrap carrier.

The Watts furnaces are sold up for this year, but can take care of a limited number of orders for delivery beginning in January. Let us know how much you need and we shall make you the most favorable prices.

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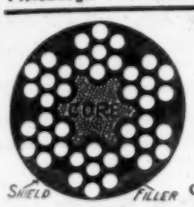

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fully appreciate the benefits and economies to be realized from the installation of a compressed air system in an ordinary machine shop where nothing but ordinary machine work is done.

The question is often discussed as to which is the better system to install, the compressed air or the electric, and as to which is the more economical. Our answer is that both are necessary. Each has its own place in the modern shop, and a brief consideration will show that neither one can fully take the place of the other. Take the case of a traveling crane, for example. There have been very good cranes of this kind with compressed air as the motive power, but it involves both coiling up and paying out the hosepipe as the crane travels along the tracks or the carriage travels along the crane girders. It involves, also, reciprocating motors which operate at high speed and are noisy and require considerable care. It is clear that electricity must here take precedence, as the easy transference of the electric current by the trolley and the adoption of the rotary and smooth running motor make it far superior. On the other hand, for hoists about the shop and even for jib cranes of moderate capacity, there is no arrangement yet devised that had quite the simplicity, the convenience and the steady action of the air hoist consisting of a cylinder in which a plunger operates directly upon the chain.

In general it may be said that where a motor is necessary electricity is the better motive power to use. Many rotary motors have been devised for utilizing compressed air, but here as with steam the reciprocating motor is likely to hold its own, and for the same reasons, and any who have heard small compressed air motors of this description run can appreciate their disadvantages. Exceptions are to be found, evidently in the case of small hand motors for drilling and similar operations to which electricity is not at all adapted and where compressed air has been found to give excellent results.

After a compressed-air system has been introduced into a plant the surprising thing is to find to how many uses it will be applied. In the foundry it is far more effective than rattlers for cleaning castings in connection with the sand blast, and its use in operating chipping hammers is well known.

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Ticket agents of the Pennsylvania lines will answer inquiries about low fares to Florida and winter resorts in the South. Full information concerning Tourist Tickets, time tables, etc., will be furnished free. Persons contemplating a Southern trip may secure valuable information on the subject by merely inquiring of the nearest representative of the Pennsylvania Lines, or by addressing C. L. Kimball, Assistant General Passenger Agent, Cleveland, O. Say where and when you wish to go, how many will be in the party, starting point, etc., and you will be promptly posted. The inquiry will not cost much effort—it will save considerable bother in arranging details, as they will be looked after gratis.

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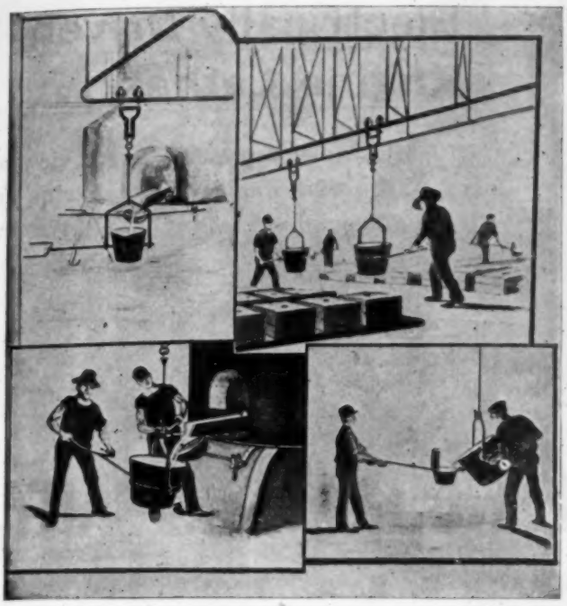

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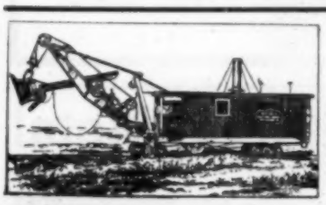

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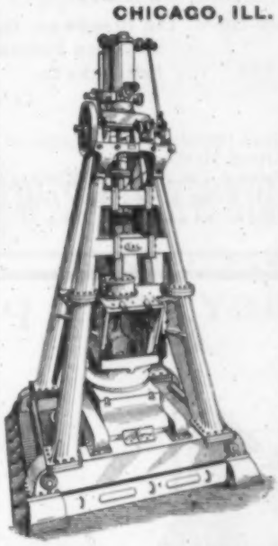

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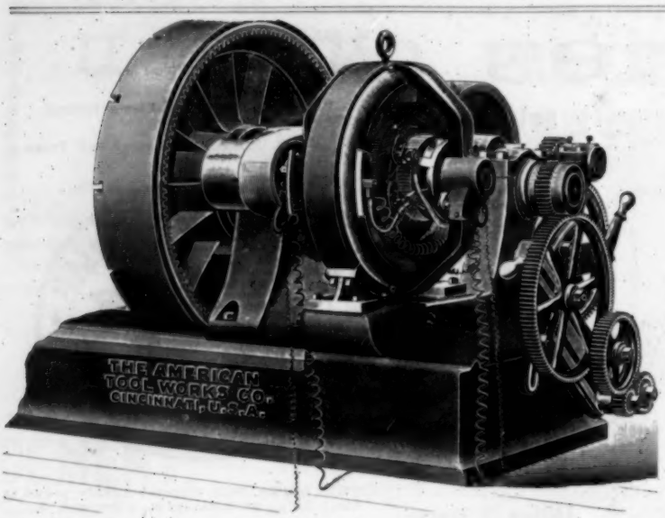

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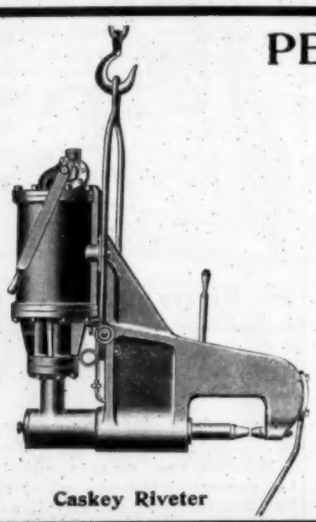

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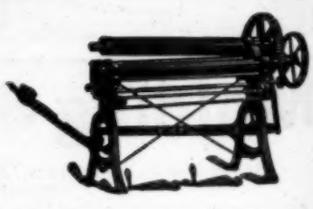

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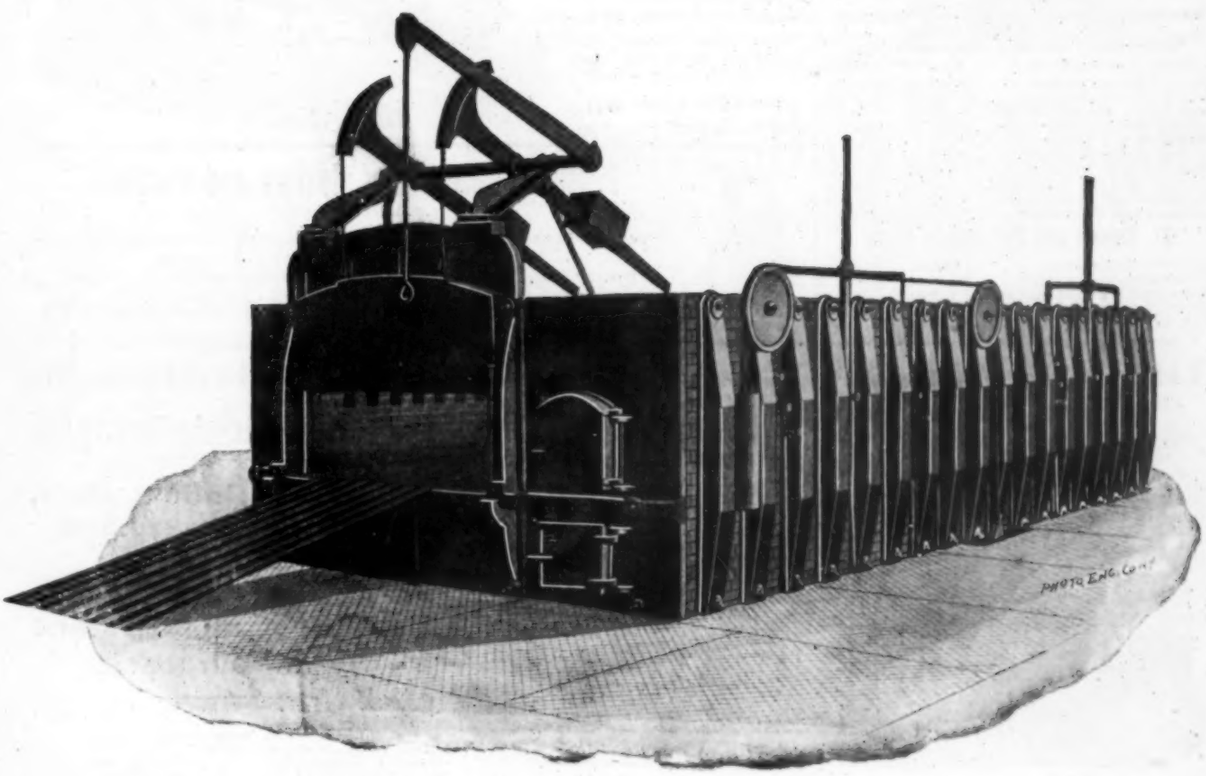

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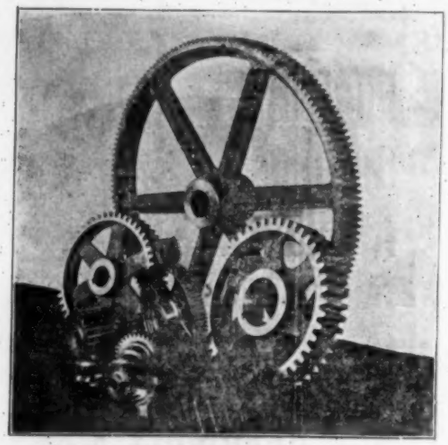

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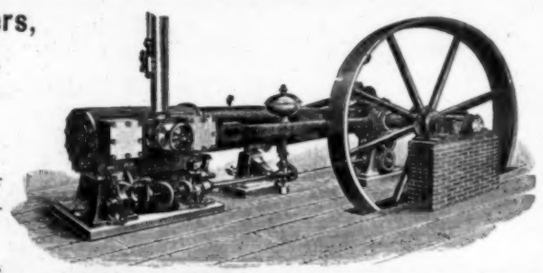

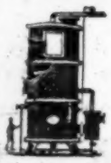

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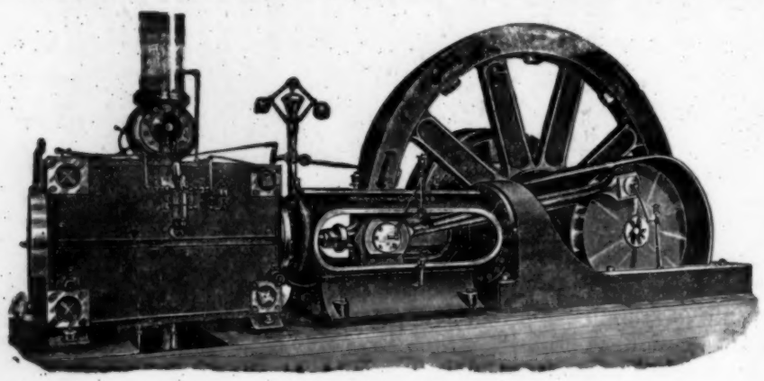

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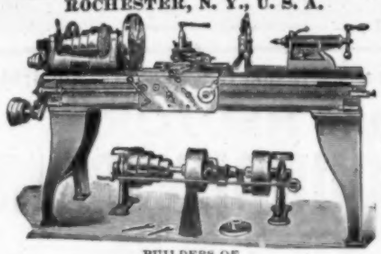

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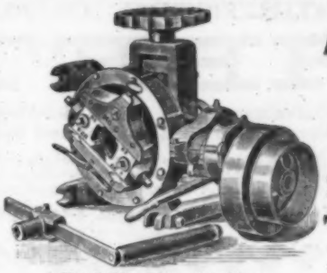

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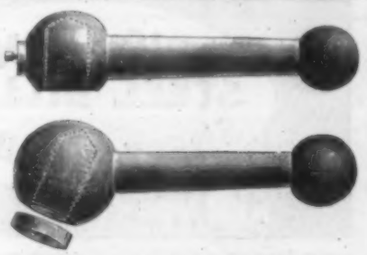

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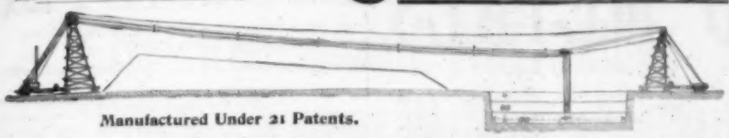

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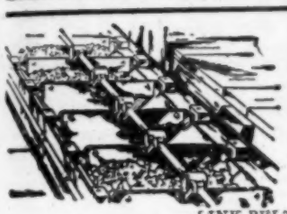

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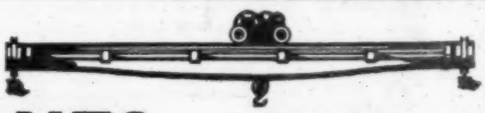

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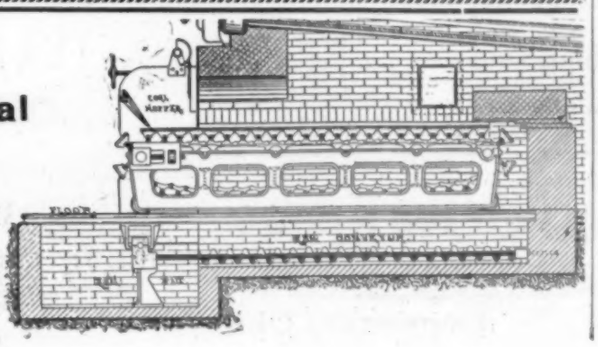

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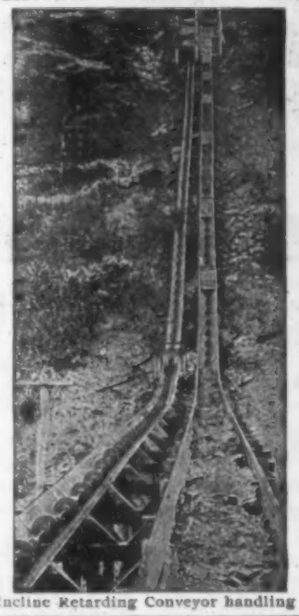

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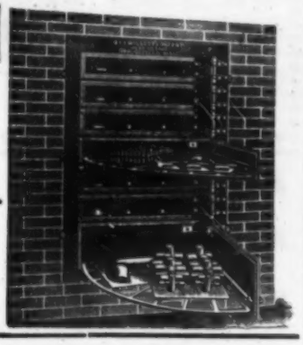

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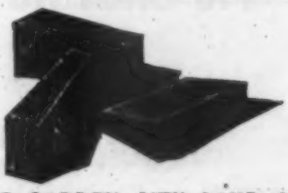

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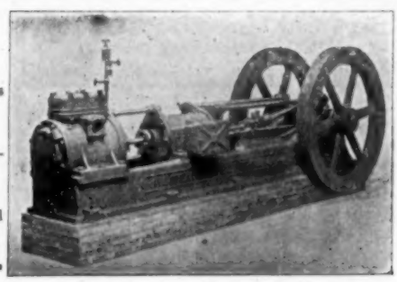

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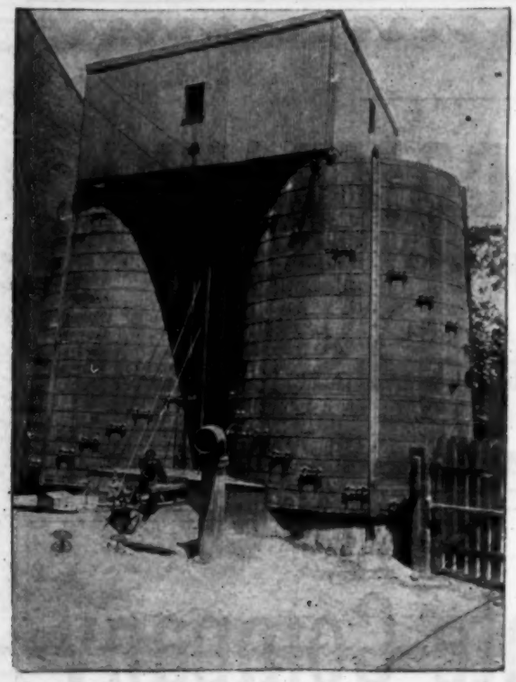

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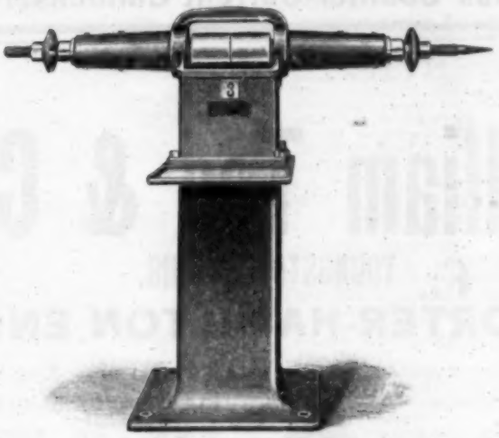

BUFFER No. 3.

Length of arbor over all, 52 inches. Length between flanges, 40 inches. Diameter of arbor through bearings, ¾ inch. Diameter through collars, 1 inch or 1¼ inch. Pulleys, 4 inch x 4 inch. Height from floor to center of arbor, 39 inches.

COMPLETE CATALOGUE ON APPLICATION.

..5 Ton..

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Revolving and Traveling.

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For handling Iron Ore Coal and Sand...

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Car Unloaders,
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IRON AND STEEL MARKETS.

IRON ORE.

[On Lake Erie Docks.]

Special low-phosphorus hard ore, Bessemer	$5.50
No. 1 Specular, Bessemer	$4.25@ 5.00
No. 1 Bessemer, hematite	4.00@ 4.75
Hematites No. 1 non-Bessemer	3.50@ 3.75
No. 1 Specular, non-Bessemer	3.50@ 4.00
Mesabi Bessemer	3.50@ 4.00

PIG IRON.

Cleveland (f. o. b. cars):

Bessemer	$24.00
No. 1 Strong Foundry	$23.00@ 23.50
No. 2 Strong Foundry	23.50@ 23.75
Gray Forge, red short	21.50@ 21.75
No. 1 American Scotch	23.00@ 23.50
No. 2 American Scotch	22.25@ 22.75
Lake Superior Charcoal	25.00@ 29.00

OLD RAILS AND SCRAP METAL.

[Delivered Cleveland.]	Gross Tons.
Old iron rails	$30.00
Old steel rails (6 ft. and over)	21.00
Old steel rails (6 ft. and under)	22.00
Old car wheels	22.00
	Net Tons.
No. 1 R. R. wrought scrap	$25.00
Mill scrap	17.00
No. 1 Machine cast scrap	17.00
Iron axles	28.00
Axle turnings	16.00
Wrought turnings (free from cast)	13.00
Cast borings	11.00
Uncut wrought iron boilers	16.00
Steel boiler plates	16.00
Grate bars	11.00
Pipes and flues (clean)	15.00
Tank Iron	16.00
Hoop and band iron	12.00
Sheet iron	10.00
Wrought drillings	13.00
Malleable iron	15.00

STRUCTURAL MATERIAL.

Beams and channels (f. o. b. Cleveland)	2.35c
Angles	2.35@ 2.45c
Tees	2.45c
Universal plates	3.00c
Sheared plates	3.00c

MERCHANT IRON & STEEL.

[Less than car-lots, Cleveland.]

Rounds and Squares—Bar Iron.

1 to 1⅞	2.50 Base.
2 to 2¾	.20 extra.
3 to 3½	.50 "
3¾ to 4	.80 "
4⅛ to 4¾	1.00 "
4⅞ to 5	1.30 "
5⅛ to 6	1.80 "
6⅛ to 6¾	2.20 "
6⅞ to 7¾	2.50 "
⅛ to ⅜	.10 "
7-16 to 11-16	.20 "
½ to 9-16	.30 "
7-16 to 15-32	.40 "
½ to 13-72	.50 "
5-16 to 1-32	.70 "
⅛ to 9-32	.90 "
7-32	1.40 "
3-16	2.50 "

Flats.—Bar Iron.

1¼ to 4 x ¼ to 1	1.05 Base
4¼ to 6 x ¼ to 1	.10 extra
6¼ to 8 x ¼ to 1	.60 "
8¼ to 10 x ¼ to 1	.80 "
1¼ to 4 x 1 1-16 to 1½	.30 "
4¼ to 6 x 1 1-16 to 1½	.40 "
6¼ to 8 x 1 1-16 to 1½	.60 "
8¼ to 10 x 1 1-16 to 1½	.90 "
2 to 4 x 1⅝ to 2	.50 "
4¼ to 6 x 1⅝ to 2	.60 "
6¼ to 8 x 1⅝ to 2	.80 "
8¼ to 10 x 1⅝ to 2	1.00 "
2 to 4 x 2⅛ to 3	.60 "
4¼ to 6 x 2⅛ to 3	.80 "
6¼ to 8 x 2⅛ to 3	1.00 "
1¼ to 1¾ x ⅜ to 1	.10 "
1 to 1 1-16 x ⅜ to ⅝	.20 "
⅝ to 15-16 x ⅜ to ⅝	.40 "
⅝ to 11-16 x ⅜ to ⅝	.50 "
⅛ to 9-16 x ⅜ to ⅝	.50 "

Heavy Band Iron.

7 to 10 x ⅛ to 5-16	.70 extra.
6¼ to 6¼ x ⅛ to 5-16	.50 "
4¼ to 6 x ⅛ to 5-16	.30 "
1¼ to 4 x ⅛ to 5-16	.20 "
1 to 1¾ x ⅛ to 5-16	.30 "
⅛ to 15-16 x ⅛ to 5-16	.50 "
⅝ to 11-16 x ⅛ to 5-16	.80 "
⅛ to 9-16 x ⅛ to 5-16	1.00 "
⅛ to 7-16 x ⅛ to 5-16	1.50 "

Heavy bands, 7-32 in. thick 1-10 c. per lb. higher than ⅛ to 5-16 thick. Bevel Edge Shaft Iron 1-10 higher than same size of Heavy Bands.

Light Band Iron.

7 to 8 x No. 9 to 3-16	1.00 extra
7 to 8 x Nos. 10, 11 and 12	1.00 "
6¼ to 6¼ x No. 9 to 3-16	.70 "
6¼ to 6¼ x Nos. 10, 11 and 12	.80 "
4¼ to 6 x No. 9 to 3-16	.50 "
4¼ to 6 x Nos. 10, 11 and 12	.60 "
1¼ to 4 x No. 9 to 3-16	.40 "
1¼ to 4 x Nos. 10, 11 and 12	.50 "
1 to 1 3-16 x No. 9 to 3-16	.50 "
1 to 1 3-16 x Nos. 10, 11 and 12	.60 "
13-16 to ⅞ x No. 9 to 3-16	.60 "
13-16 to ⅞ x Nos. 10, 11 and 12	.70 "
11-16 to ¾ x No. 9 to 3-16	.80 "
11-16 to ¾ x Nos. 10, 11 and 12	.90 "
9-16 to ⅝ x No. 9 to 3-16	1.00 "
9-16 to ⅝ x Nos. 10, 11 and 12	1.10 "

16 to ¼ x No. 9 to 3-16	1.30 extra
7-16 to ½ x Nos. 10, 11 and 12	1.40
¾ x No. 9 to 3-16	1.50
¾ x Nos. 10, 11 and 12	1.60

Bevel Edge Box Iron.

Same as Light Bands, of same sizes.

Beaded Band Iron, 1¼ in. to 2 in.

Sand Band Iron, 1-10 c. above same sizes of Light Bands.

Oval Iron.

¼ to 1¼	.40 extra
¼ to 13-16	.50 "
¼ to 11-16	.60 "
¼ to 9-16	.80 "
¼ to 7-16	1.10 "
¼ to 9-16 x 3-16	1.00 "
¼ to 11-16 x ¼	1.20 "

Half Oval and Half Round.

2¼ to 3	.60 extra
¼ to 2	.50 "
¼ to 13-16	.70 "
¼ to 11-16	.90 "
¼ to 9-16	1.20 "
¼ to 7-16	2.50 "
5-16	3.50 "
¼	4.50 "

Half Ovals less than ¼ their width in thickness extra price.

Horse Shoe Iron.

All sizes 1 c. extra.

Cutting ordinary bars to specified length, .20 to .30 extra, according to length and size.

Steel Bands.

Width in Inches.	English Standard Gauge.	
1 1-2 to 6,	Nos. 7, 8, 9 or 3-16"	1.50 Base.
		Extras.
1¼ to 6,	" 10, 11, 12 or ¼"	.05 per 100 lbs.
1 to 1¼,	" 7, 8, 9 or 3-16"	.10 "
1 to 1¼,	" 10, 11, 12 or ¼"	.15 "
13-16 and ⅞,	" 7, 8, 9 or 3-16"	.20 "
13-16 and ⅞,	" 10, 11, 12 or ¼"	.25 "
11-16 and ¾,	" 7, 8, 9 or 3-16"	.30 "
11-16 and ¾,	" 10, 11, 12 or ¼"	.35 "
9-16 and ⅝,	" 7, 8, 9 or 3-16"	.40 "
9-16 and ⅝,	" 10, 11, 12 or ¼"	.45 "
½,	Nos. 7, 8, 9 or 3-16"	.55 "
½,	" 10, 11, 12 or ¼"	.60 "
7-16	" 7, 8, 9 or 3-16"	.75 "
7-16	" 10, 11, 12 or ¼"	.85 "
⅜,	" 7, 8, 9 or 3-16"	.95 "
⅜,	" 10, 11, 12 or ¼"	1.05 "

Iron and Steel Hoops.

Width Inches.	English Standard Gauge.	
7-16 to 3	Nos. 13, 14, 15 and 16	1.60 Base
		Extras.
7-16 to 2,	" 17, 18, and 19	.05 per 100 lbs
7-16 to 2,	" 20	.10 "
7-16 to 2,	" 21	.15 "
7-16 to 1¼,	" 22	.25 "
½ to 1¼,	" 13, 14 and 15	.05 "
½ to 1¼,	" 16, 17 and 18	.10 "
1¼ to 1¾,	" 19 and 20	per 100 lbs.
1¼ to 1¾,	" 21	.20 "
1¼ to 1¾,	" 22	.30 "
15-16 and 1,	" 13, 14 and 15	"
15-16 and 1,	" 16, 17 and 18	.15 "
15-16 and 1,	" 19 and 20	.20 "
15-16 and 1,	" 21	.25 "
15-16 and 1,	" 22	.35 "
⅝,	Nos. 13, 14 and 15	.20 "
⅝,	" 16, 17 and 18	.25 "
⅝,	" 19 and 20	.30 "
⅝,	" 21	.35 "
⅝,	" 22	.45 "
¾ and 13-16	Nos. 13, 14 and 15	.30 "
¾ and 13-16	" 16, 17 and 18	.35 "
¾ and 13-16	" 19 and 20	.40 "
¾ and 13-16	" 21	.45 "
¾ and 13-16	" 22	.50 "
¾ and 13-16	" 23	.60 "
11-16,	Nos. 13, 14 and 15	.35 "
11-16,	" 16, 17 and 18	.40 "
11-16,	" 19 and 20	.50 "
11-16,	" 21	.60 "
11-16,	" 22	.70 "
11-16,	" 23	.80 "
⅝,	Nos. 13, 14 and 15	.40 "
⅝,	" 16, 17 and 18	.45 "
⅝,	" 19 and 20	.55 "
⅝,	" 21	.65 "
⅝,	" 22	.75 "
⅝,	" 23	.85 "
9-16,	" 13, 14 and 15	.45 "
9-16,	" 16, 17 and 18	.50 "
9-16,	" 19 and 20	.60 "
9-16,	" 21	.70 "
9-16,	" 22	.80 "
9-16,	" 23	.90 "
⅝,	" 13, 14 and 15	.55 "
⅝,	" 16, 17 and 18	.60 "
⅝,	" 19 and 20	.70 "
⅝,	" 21	.80 "
⅝,	" 22	.90 "
⅝,	" 23	1.00 "
7-16,	" 13, 14 and 15	.80 "
7-16,	" 16, 17 and 18	.90 "
7-16,	" 19 and 20	1.00 "
½,	" 13, 14 and 15	1.00 "
½,	" 16, 17 and 18	1.10 "
½,	" 19 and 20	1.30 "

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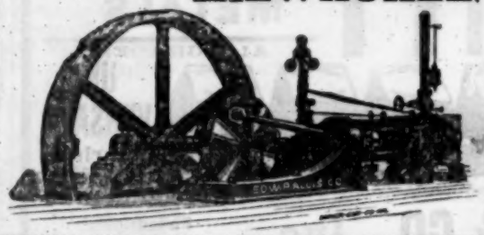

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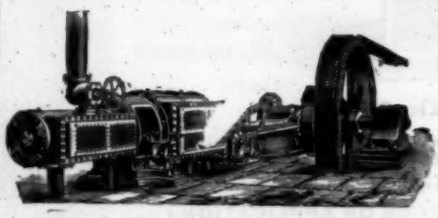

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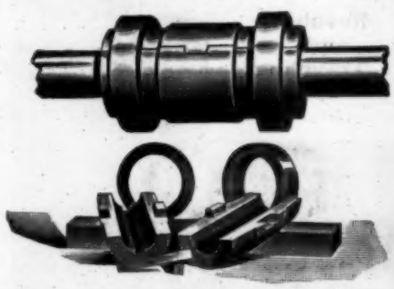

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Riter-Conley Mfg. Co., Pittsburg, Pa.
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co, Harvey, Ill.

DIES—
Danielson Machine & Tool Co., Cleveland, O.

DREDGES—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.

DRILL GRINDERS—
J. Wendell Cole Columbus, O.

DRILL PRESSES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.
Manning, Maxwell & Moore, New York City.
Danielson Machine & Tool Co., Cleveland, O.

DROP FORGINGS—
Wyman & Gordon, Worcester, Mass.
Chicago Drop Forge & Foundry Co., Kensington, Ill.

DROP HAMMERS—
Baush & Harris Machine Tool Co., Springfield, Mass.

DROP PRESSES—
Avery Stamping Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
E. Konigslow & Bro., Cleveland, O.
Danielson Machine & Tool Co, Cleveland, O.

DYNAMOS—
Jeffrey Mfg. Co., Columbus, O.

EAVE TROUGHS AND CONDUCTORS—
Berger Mfg. Co., Canton, O.

ELEVATORS—
Whiting Foundry Equipment Co., Harvey, Ill.

ELEVATING AND CONVEYING MACHINERY—
Heyl & Patterson, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Lidgerwood Mfg. Co., New York City.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster Camp & Lane Machine Co., Akron, O
Buhl Malleable Co., Detroit, Mich.
Excelsior Iron Works Co., Cleveland, O.

EMERY AND CORUNDUM WHEELS—
Star Corundum Wheel Co., Detroit, Mich.
C. H. Besley & Co, Chicago, Ill.
J. Wendell Cole, Columbus and Chicago.
Northampton Emery Wheel Co., Chicago, Ill.
W. P. Davis Machine Co., Rochester, N. Y.

EMERY WHEEL MACHINERY—
J. Wendell Cole, M.E., Columbus, O., or Chicago
Star Corundum Wheel Co., Detroit, Mich.
C. H. Besly & Co., Chicago, Ill.
Northampton Emery Wheel Co., Chicago, Ill.
W. P. Davis Machine Co., Rochester, N. Y.

ENGINEERS AND CONTRACTORS—
Wellman-Seaver Engineering Co., Cleveland, O
Walter Kennedy, Pittsburg Pa.
Heyl & Patterson, Pittsburg, Pa.
Meehan Boiler & Construction Co., Lowellville, O
E. E. Erickson, Pittsburg, Pa.
John T. Jones & Co., Chicago, Ill.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Alex Laughlin & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
James Bonar & Co., Pittsburg, Pa.

ENGINE PACKING—
Jenkins Bros., New York City.
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

ENGINEERS' SUPPLIES—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
James B. Clow & Sons, Chicago, Ill.

ENGINE LATHES—
U. Baird Machinery Co., Pittsburg, Pa.
American Tool Works Co., Cincinnati, O.

ENGINES (OIL)—
The Aultman Co., Canton, O.

ENGINES STEAM)—
W. P. Davis Machine Co., Rochester, N. Y
Wm. Tod & Co., Youngstown, O.
The Edward P. Allis Co,, Milwaukee, Wis.

The Hooven, Owens & Rentschler Co., Hamilton, O.
The Aultman Co., Canton, O.
Geo. B. Sennett Co., Youngstown, Ohio.

ENGRAVERS AND ELECTROTYPERS—
Central Electrotype & Engraving Co., Cleveland.
National Engraving Co., Cleveland, O.,
Samuel R. Mason, Cleveland, O.

FEED WATER HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
Austin Separator Co., Detroit, Mich.

FELLOE PLATES—
Avery Stamping Co., Cleveland, O.

FILES, MAKERS OF—
C. H. Besly & Co., Chicago, Ill.

FILTERS—
Wm. B. Scaife & Sons, Pittsburg, Pa.

FIRE BRICK AND CLAY—
J. V. Rose, Sharon, Pa.
Union Mining Co., Mt. Savage, Md.
Clearfield Fire Brick Co., Clearfield, Pa.
Dover Fire Brick Co., Cleveland, O.
F. B. Stevens, Detroit, Mich.
Chicago Fire Clay Product Co., Chicago, Ill.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Detroit, Mich.
Garden City Sand Co., Chicago, Ill.
A. F. Smith & Co., New Brighton, Pa.
Chas. Taylor's Sons Co. Cincinnati, O.

FIRE PROOF COVERING—
C. H. Besly & Co., Chicago, Ill.

FLEXIBLE SHAFTS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

FLUE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

FOOT AND POWER LATHES—
U. Baird Machinery Co., Pittsburg, Pa.

FORGINGS—
Chicago Drop Forge & Foundry Co., Kensington, Ill.
Cleveland City Forge & Iron Co., Cleveland, O.
Bethlehem Steel Co., South Bethlehem, Pa.
Bræburn Steel Co., Braeburn, Pa.
Wyman & Gordon, Worchester, Mass.
Danielson Machine & Tool Co., Cleveland, O.
Samuel Trethewey & Co., Pittsburg, Pa.

FOUNDRIES—
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.
Hooven, Owens & Rentschler Co., Hamilton, O.
W. A. Jones Foundry Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
Brass Founders' Supply Co., Newark, N. J.
The Aultman Co., Canton, O.
Riverside Foundry Co., Cleveland, O.
I. & R. Greenwald Co., Cincinnati, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va.
Excelsior Iron Works Co., Cleveland, O.
Macbeth & Co., Cleveland, O.

FOUNDRY EQUIPMENT.
Miller & Hays, Akron, O.
Tabor Mfg. Co., Elizabeth, N. J.
Millett Core Oven Co., Brightwood, Mass.
Brass Founders Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Northern Engineering Works, Detroit, Mich.
Cleveland Crane & Car Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.

FOUNDRY FACINGS—
Cleveland Facing Mill Co., Cleveland, O.

FOUNDRY SUPPLIES—
Northern Engineering Works, Detroit, Mich.
Chas. Taylor's Sons Co., Cincinnati, O.
Miller & Hays, Akron, O.
Clearfield Fire Brick Co., Clearfield, Pa.
Cleveland Crane & Car Co., Cleveland, O.
The Ohio Sand Co., Conneaut, O.
Union Mining Co., Mt. Savage, Md.
Dover Fire-Brick Co., Cleveland, O.
A. F. Smith & Co., New Brighton, Pa.
Tabor Mfg. Co., Elizabeth, N. J.
F. B. Stevens, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
Millett Core Oven Co., Brightwood, Mass.
Cleveland Facing Mill Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
Chicago Fire Clay Product Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth, O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
J. V. Rose, Sharon, Pa.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

FRICTION METAL—
James B. Clow & Sons, Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.
Swarts Metal Refining Co., Chicago, Ill.
Magnolia Metal Co., New York City.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelphia, Pa.
F. R. Phillips' Sons Co., Philadelphia, Pa.
J. J. Ryan & Co., Chicago, Ill.

FURNACES—
Playford Stoker Co., Cleveland, O.

FURNACE LININGS—
Union Mining Co., Mt. Savage, Md.

FURNACE, MELTING—
Whiting Foundry Equipment Co., Harvey, Ill.

FUEL OIL BURNERS—
W. S. Rockwell & Co., New York City.

GALVANIZED IRON—
Apollo Iron & Steel Co., Pittsburg, Pa.

GALVANIZERS—
Ætna-Standard Iron & Steel Co., Bridgeport, O
Apollo Iron & Steel Co., Pittsburg, Pa.

GALVANIZING POTS—
The Wm. B. Pollock Co., Youngstown, O.

GAS ENGINES—
Northern Engineering Works, Detroit, Mich.

GAUGE COCKS—
James Bonar & Co., Pittsburg, Pa.

GEARING—
I. & R. Greenwald Co., Cincinnati, O.
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.
Fraser & Chalmers, Chicago, Ill.
Southwark Foundry & Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.

GEAR CUTTING—
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.

GEAR LUBRICANTS—
The Ironsides Company, Columbus, O.

GIRDER WORK—
Wm. B. Scaife & Sons, Pittsburg, Pa.

GRINDSTONES—
C. H. Besly & Co., Chicago, Ill.

GRAPHITE PAINT—
Jos Dixon Crucible Co., Jersey City, N. J.

GRATE BARS—
Geo. B. Sennett Co., Youngstown, Ohio.

GRAY IRON CASTINGS—
W. A. Jones Foundry Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.

HACK SAWS—
Q & C Co., Chicago, Ill.

HANDLES—
Norwood Bicycle Co., Cincinnati, O.

HANGERS—
R. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & R. Greenwald Co., Cincinnati, O.

HARNESS SNAPS—
Covert Mfg. Co., West Troy, N. Y.

HOISTS—
Reading Crane & Hoist Works, Reading, Pa.
The Aultman Co., Canton, O.
Lidgerwood Mfg. Co., New York City.

HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
Austin Separator Co., Detroit, Mich.

HEAVY HARDWARE—
C. H. Besly & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.

HOISTING ENGINES—
The Edward P. Allis Co., Milwaukee, Wis.
Lidgerwood Mfg. Co., New York City.
The Aultman Co., Canton, O.
Webster, Camp & Lane Machine Co., Akron, O.
Excelsior Iron Works Co., Cleveland, O.

HOISTING MACHINERY—
Link-Belt Machinery Co., Chicago, Ill.
Reading Crane & Hoist Works, Reading, Pa.
Jeffrey Mfg. Co., Columbus, O.
Excelsior Iron Works Co., Cleveland, O.
Lidgerwood Mfg. Co., New York City.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster, Camp & Lane Machine Co., Akron, O.

HORSE SHOES—
Phoenix Horse Shoe Co., Joliet, Ill.

HOTELS—
United States Hotel Co., Cleveland, O.

IMPULSE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

INDUSTRIAL CARS—
The Pressed Steel Car Co., Pittsburg, Pa.

INGOT MOLDS—
Lorain Foundry Co., Lorain, O.

INJECTORS—
C. H. Besly & Co., Chicago, Ill.
Manning, Maxwell & Moore, New York City.
James Bonar & Co., Pittsburg, Pa.

INSURANCE COMPANIES—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.

IRON BUILDINGS—
Schiffler Bridge Co., Pittsburg, Pa.
Riter-Conley Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.

IRON, NAILS AND STEEL—
C. H. Besly & Co., Chicago, Ill.
E. H. Stroud & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.
L. K. Hirsch, Chicago, Ill.

IRON AND STEEL ROOFING—
Berger Mfg. Co., Canton, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
Cincinnati Corrugating Co., Piqua, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.

IRON ORE—
Lake Superior Consolidated Iron Mines New York City, N. Y.
Oglebay, Norton & Co., Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
Drake Bartow & Co., Cleveland, O.
Pickands, Mather & Co., Cleveland, O.

IRON WORKING TOOLS—
Avery Stamping Co., Cleveland, O.
American Tool Works Co., Cincinnati, O.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Armstrong Bros. Tool Co., Chicago, Ill.
The Armstrong Mfg. Co., Bridgeport, Conn.
Bickford Drill & Tool Co., Cincinnati, O.
Skinner Chuck Co., New Britain, Conn.
Baush & Harris Machine Tool Co., Springfield, Mass.
W. P. Davis Machine Co., Rochester, N. Y.
Manning, Maxwell & Moore, New York City.
Bertsch & Co., Cambridge City, Ind.
Skinner Chuck Co., New Britain, Conn.

LADLES—
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

LATHES—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
American Tool Works Co., Cincinnati, O.

LINK BELTING—
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.

MACHINISTS' TOOLS AND SUPPLIES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bertsch & Co., Cambridge City, Ind.
Armstrong Bros. Tool Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
Parkhurst & Wilkinson Co., Chicago, Ill.
Skinner Chuck Co., New Britain, Conn.
Baush & Harris Machine Tool Co., Springfield Mass.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.

MACHINE SCREWS—
C. H. Besly & Co., Chicago, Ill.

MACHINE SHOPS—
The R. D. Nuttall Co., Allegheny, Pa.
Danielson Machine & Tool Co., Cleveland, O.

MACHINERY AND TOOL STEEL—
C. H. Besley & Co., Chicago, Ill.
Bræburn Steel Co., Braeburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa
Byron H. White, Chicago, Ill.
Morris & Bailey Steel Co., Pittsburg, Pa.
Monongahela Iron & Steel Co., Pittsburg, Pa.

MAGNESIA COVERING—
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

MALLEABLE FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill.

MALLEABLE CASTINGS—
Acme Malleable Iron Works, Buffalo, N. Y.
Buhl Malleable Co., Detroit, Mich.
Forster, Waterbury & Co., Chicago, Ill.

MANUFACTURING CHEMISTS—
We Fu Go Co., Cincinnati, O.

MANUFACTURED IRON AND STEEL—
Bourne-Fuller & Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Parkhurst & Wilkinson Co., Chicago, Ill.
Ohio Steel Co., Youngstown, O.
Republic Iron & Steel Co., Chicago, Ill.
Monongahela Iron & Steel Co., Pittsburg, Pa.

METAL BEARINGS—
C. H. Besly & Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelphia, Pa.
Magnolia Metal Co., New York City.
Swarts Metal Refining Co., Chicago, Ills.
F. R. Phillips' Sons Co., Philadelphia, Pa.
J. J. Ryan & Co., Chicago, Ill.

METAL CEILINGS—
Berger Manufacturing Co., Canton, O.

METAL WORK—
Avery Stamping Co., Cleveland, O.

MILLING MACHINES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.

MINING MACHINERY—
C. H. Besly & Co., Chicago, Ill.
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
Wm. Cramp & Sons, Philadelphia, Pa.
The Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Webster, Camp & Lane Machine Co., Akron, O.
Fraser & Chalmers, Chicago, Ill.
Excelsior Iron Works Co., Cleveland, O.

MINE PUMPS—
F. M. Prescott Steam Pump Co., Milwaukee, Wis.

MOLDING MACHINES—
Tabor Mfg. Co., Elizabeth, N. J.
Whiting Foundry Equipment Co., Harvey, Ill.

MOLDING SAND—
Ohio Sand Co., Conneaut, O.
F. B. Stevens, Detroit, Mich.
Garden City Sand Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

MULTIPLE DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.

NICKEL PLATING OUTFITS—
Northampton Emery Wheel Co., Chicago, Ill.

NUTS AND BOLTS—
Upson Nut Co., Cleveland, O.

OILLESS BEARINGS—
C. H. Besly & Co., Chicago, Ill.

OIL BURNERS—
W. S. Rockwell & Co., New York City.

OIL CUPS—
C. H. Besly & Co., Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

OIL FILTERS—
James Bonar & Co., Pittsburg, Pa.

OIL PUMPS—
C. H. Besly & Co., Chicago, Ill.

OIL SEPARATORS—
Harrison Safety Boiler Works, Philadelphia, Pa.
Austin Separator Co., Detroit, Mich.

ORE CARS—
The Pressed Steel Co. Pittsburg, Pa.

ORE CRUSHERS—
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers Chicago, Ill.

ORE SCREENS—
Rob't Aitchison Per. Metal Co., Chicago, Ill.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

PACKING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
James B. Clow & Sons, Chicago, Ill.

PAINT—
Iron Clad Paint Co., Cleveland, O.
Jos. Dixon Crucible Co., Jersey City, N. J.

PATTERN WORKS—
Gobeille Pattern Co., Cleveland O.
Forsythe Pattern Works, Youngstown, O.

PERFORATED METALS—
Aitchison Perforated Metal Co., Chicago, Ill.
Fraser & Chalmers, Chicago, Ill.

PIG IRON—
Rogers, Brown & Co., Cincinnati, O.
Reed F. Blair & Co., Pittsburg, Pa.
Clinton Iron & Steel Co., Pittsburg.
Forster, Waterbury & Co., Chicago, Ill.
Bourne-Fuller Co. Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
E. H. Stroud & Co., Chicago, Ill.
F. B. Stevens, Detroit, Mich.
McKeefrey & Co., Leetonia, O.
Superior Charcoal Iron Co., Grand Rapids, Mich
Spearman Iron Co., Sharpsville, Pa.
Hickman, Williams & Co., Chicago, Ill,
The Brier Hill Coal & Iron Co., Youngstown, O.
Pickands, Mather & Co., Cleveland, O.
Republic Iron & Steel Co., Chicago, Ill.
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill,

PIG IRON CASTING APPARATUS—
Heyl & Patterson, Pittsburg, Pa.
G. H. Ginther, Special Agent, Pittsburg, Pa.

PIPE (CAST IRON)—
James B. Clow & Sons, Chicago, Ill.

PIPE (RIVETED STEEL)—
Wm. B. Scaife & Sons, Pittsburg, Pa.

PIPE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

PIPE COVERING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

PIPE CUTTING AND THREADING MACHINES—
The Armstrong Mfg. Co., Bridgeport, Conn.

PIPE FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill.

PLANERS—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O
Manning, Maxwell & Moore, New York City.
American Tool Works Co., Cincinnati, O.

PLATES—
Enterprise Boiler Co., Youngstown, O.
Republic Iron & Steel Co., Chicago, Ill.

PLUMBERS' AND GAS FITTERS' SUPPLIES—
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

PNEUMATIC APPLIANCES—
Clayton Air Compressor Works, New York.

PNEUMATIC TOOLS—
American Pneumatic Tool Co., New York City
Q & C Co., Chicago, Ill.

PORTABLE FORGE—
C. H. Besly & Co., Chicago, Ill.
Vulcan Mfg. Co., Pittsburg, Pa.

POWER DROP HAMMERS—
Baush & Harris Machine Tool Co., Springfield Mass.

POWER PRESSES—
Avery Stamping Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.

POWER TRANSMISSON MACHINERY—
Jeffrey Mfg. Co., Columbus, O.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.

PRESSES—
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Avery Stamping Co., Cleveland, O.

PRESSURE GAUGES—
The Bristol Co., Waterbury, Conn.
James Bonar & Co., Pittsburg, Pa.

PULLEYS—
W. A. Jones Foundry Co., Chicago, Ill
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.

PUMPS (STEAM)—
The Edward P. Allis Co., Milwaukee, Wis
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred M. Prescott Steam Pump Co., Milwaukee Wis.
Hall Steam Pump Co., Pittsburg, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.

PUNCHES—
E. Konigslow & Bro. Cleveland, O.

PYROMETERS—
Edward Brown, Philadelphia, Pa.
Vulcan Mfg. Co., Pittsburg, Pa.

RADIAL DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.

RAILWAY SUPPLIES—
Cleveland City Forge & Iron Co., Cleveland, O
Garden City Sand Co., Chicago, Ill.
L. K. Hirsch, Chicago, Ill.

RIVETS—
Champion Rivet Co., Cleveland, O.
Jonse & Laughlins, Ltd., Pittsburg, Pa.

RIVETED STEEL PIPE—
The Wm. B. Pollock Co. Youngstown, O.

ROCK DRILLS—
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York.

ROLL FORGINGS—
Samuel Trethewey & Co., Pittsburg, Pa.

ROLLING MILL MACHINERY—
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
F. R. Phillips' Sons Co., Philadelphia, Pa
Whiting Foundry Equipment Co., Harvey, Ill.

ROOFS—
Shiffler Bridge Co., Pittsburg.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.

SAWS—
Peter Gerlach & Co., Cleveland, O.

SCRAP IRON—
L. K. Hirsch, Chicago, Ill.

SCREENS FOR COAL, ORE, ETC.—
Robt. Aitchison Perforated Metal Co., Chicago.
Harrington & King Perforating Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.

SCREWS—
C. H. Besly & Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.
Chicago Screw Co., Chicago, Ill

SCREW MACHINES—
Cleveland Ball & Screw Co., Cleveland, O.

SEPARATORS—
Harrison Safety Boiler Works, Philadelphia, Pa.
Austin Separator Co., Detroit, Mich.

SHAFTING—
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
Fitzsimmons & Co., Cleveland, O.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.
Bethlehem Steel Co., South Bethlehem, Pa.
American Steel & Wire Co., Chicago, Ill.

SHAPERS—
W. P. Davis Machine Co., Rochester, N. Y.
Baush & Harris Machine Tool Co., Springfield, Mass.
American Tool Works Co., Cincinnati, O.

SHEARING AND PUNCHING MACHINERY—
Bertsch & Co., Cambridge City, Ind.
Danielson Machine & Tool Co., Cleveland, O.

SHEAR KNIVES—
Samuel Trethewey & Co., Pittsburg, Pa.

SHEET IRON—
Ætna-Standard Iron & Steel Co., Bridgeport, O.
E. H. Stroud & Co., Chicago, Ill.
Republic Iron & Steel Co., Chicago, Ill.
Struthers Iron & Steel Co., Struthers, O.

SHIP YARDS—
Wm. Cramp & Sons, Philadelphia, Pa.

SOLID STEEL SHEAR KNIVES—
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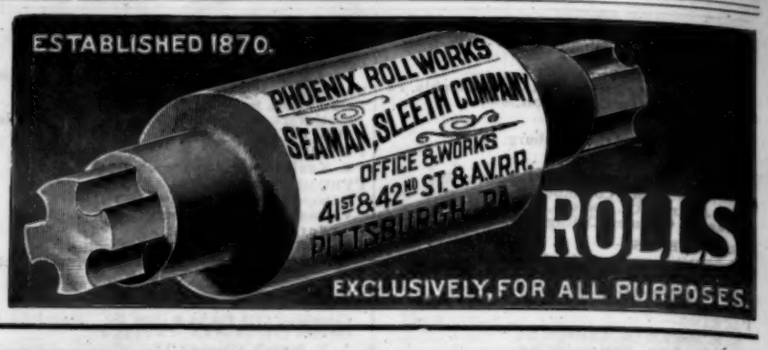

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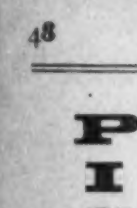

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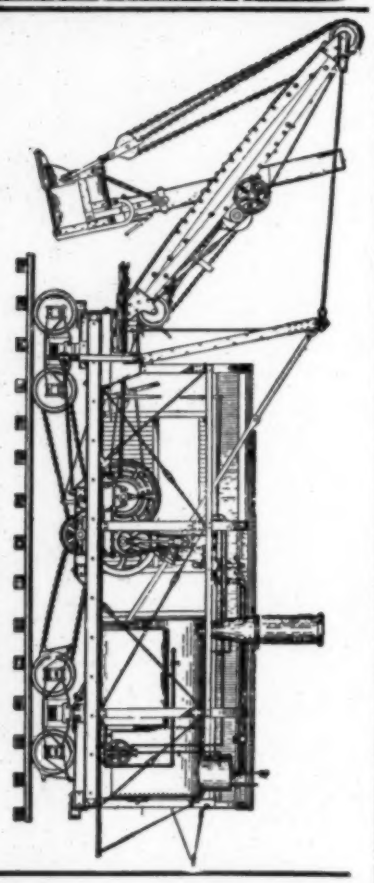

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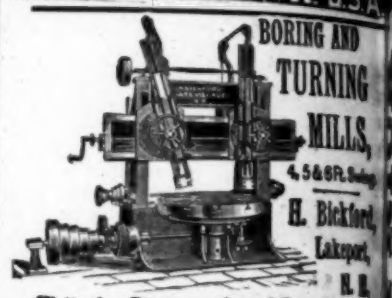

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